N. Y. State Library
C MAY 23 1927

TWO SECTIONS
(SECTION TWO)
MAY 19, 1927

AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. I. NO. 1.] NEW YORK, NOVEMBER, 1877. [$1.50 PER ANNUM.

Combination Lathe Chuck.

Every workman who has had experience in a jobbing or repairing machine-shop knows the make-shifts that are necessary to chuck work to the lathe spindle in the absence of a comprehensive chuck that shall act as a simultaneously-moving jaw chuck and one of independent jaws. In a manufactory of regular

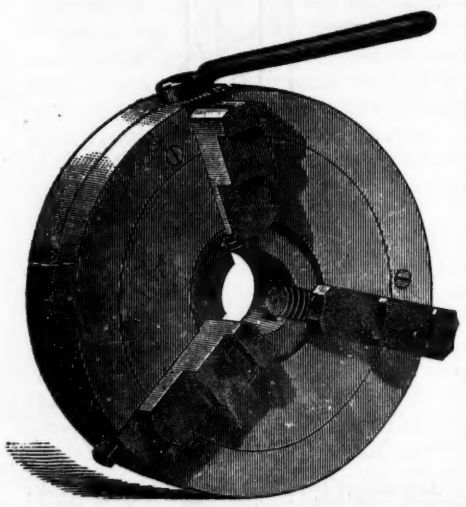


FIG. 1.

articles where one day's work is but a repetition of that of the day preceding, special chucks may be economically employed, but a in shop for general work it is very desirable to have a chuck that may be readily adapted to any common job. To meet this requirement a chuck should be at will concentric or eccentric, and be changeable from one to the other quickly and easily without being removed from the lathe spindle. In short, to sum up the requisite of a theoretically and practically perfect lathe chuck the following conditions should be fulfilled: the chuck should be light and yet strong, easily handled, positive in the movement of the jaws, holding articles firmly in position, having no uncovered slots to admit dirt and chips to the ports, be either a concentric or eccentric chuck (universal or independent jaw), and when changed to the latter be made to move its eccentrically-placed jaws simultaneously, and finally, these changes should be made while the chuck is on the spindle of the lathe. These requirements are so exacting that it would seem to be almost impossible to combine in one tool such varying, if not opposing, movements. But there is reason to believe that the result desired has been accomplished. A chuck has

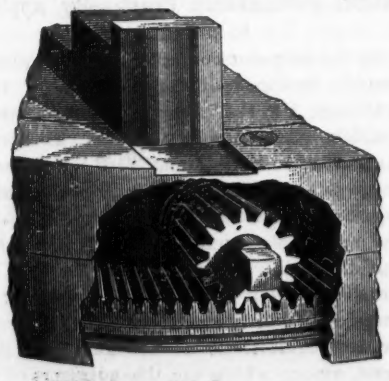


FIG. 3.

been invented by Mr. A. F. Cushman, the well-known manufacturer of lathe and drill chucks, and is being made by the Pratt & Whitney Co. of Hartford, Ct., whose well-known reputation for building fine tools needs no comments. This chuck it is claimed, combines all the above requirements, and the accompanying engravings will make it plain to any practical mechanic.

The chuck in general appearance resembles the ordinary universal or concentric chuck, and carries either three or four jaws. (Fig. 1). These jaws slide in radial slots on the face and are made of such a length that at every point from center to circumference in which they may be they cover the slots entirely, thereby excluding all dirt and chips. The jaws have three shoulders or steps, the outer or upper one of course much higher than the others, and when the jaws are reversed, as may be done in less than one minute, these long outer steps become the center ones, holding securely any small body, as the shank of a drill or reamer. That portion of the jaws which projects into the body of the chuck is cut into a half nut (A. Fig. 2) that engages with a screw (B.), the square head of which projects through the face or rim of the chuck to receive a wrench. Below this projecting head is a bevel pinion inside the rim that engages with circular rack or toothed ring. (C C) Now it is evident that turning any one of these screws will actuate the rack and every other screw, and so far there is nothing new or peculiar in the chuck. It is simply a concentric-jawed chuck. But the peculiarity of the chuck is its ease of transformation into one of excentrically-placed jaws. The groved ring rests upon a plain ring (D D), the periphery of which is a screw-thread that engages with a similar thread on the inside of the shell, so that by turning the ring in one direction it is moved forward towards the face of the chuck, and by turning it the other way it is carried towards the back of the chuck. It is evident that by this means the circular rack may be meshed in gear with the pinions in the screws, or disengaged from them (Fig. 3 and 4). When in and out of gear the ring is held in position by a spring catch. Should it be required to move one or more of the jaws further from the centre than the others, the spring catch is released by thumb-pressure; the supporting ring is turned by a knot at the back of the chuck (Fig. 5), and the circular rack unmeshed. Then the jaws, one or more, may be moved singly into the position required, when the circular rack and the screw pinions may be again meshed, forming a chuck with eccentrically-placed but simultaneously-moving jaws, an element of convenience appreciable by every machinist. When we add to these features of merit the fact that the chuck is light—one of twelve inches, weighing only about thirty pounds—that the jaws, screws, pinions and circular rack are of steel; that the jaw-screws and the pinions are of one piece, and that the chuck may be entirely dismembeted by removing three slot-headed screws while the chuck is either on the lathe spindle or the bench, it would seem that the desideratum of a practically perfect chuck is nearly attained. The advantages claimed in this chuck are as follows: First, it is very strong and durable in all its parts; second, it is easily operated, and holds work firmly for any operation; third, it can be very readily fitted to any lathe or machine; fourth, the hole through the center is larger than the average in other chucks, which is very desirable; fifth, the jaws can be reversed without removing any other parts of the chuck; sixth, it can be used as an independent jaw chuck, a universal chuck, or an eccentric chuck; seventh, all the working parts of the chuck are entirely protected from dirt and chips; eighth, all the parts can be removed for oiling and cleaning without removing the body of the chuck from the face-plate or spindle of the lathe, which is very desirable when large chucks are used.

These chucks are made in the following sizes:—Nine, twelve, fifteen, eighteen, twenty-one, twenty-four, thirty, and thirty-six inches, with either three or four jaws.

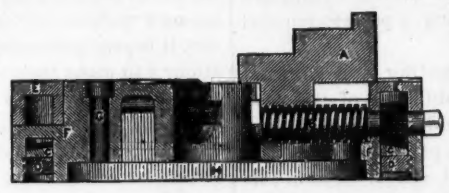


FIG. 2.

Our Export Business.

THERE is no doubt that the most direct and effectual way to introduce American machinery and tools into foreign markets is to show our foreign friends just what we manufacture and wherein the superiority over their own mechanical contrivances exists. Since the close of the Centennial Exhibition comparatively few foreigners visit the United States to make purchases of machinery and supplies, but many of them have regular representatives here who are on the alert to secure and send across the water any specially valuable articles that come under their notice, a market for which could be made through their business connections abroad. It is too much to expect that even our largest machinery houses can make it profitable to maintain either regular agencies or commercial travelers in all the principal countries where their goods find a demand. Were there concerted action of any considerable number of our manufacturers in regard to exports of machinery and tools this might be possible, but in no other way. There are too many obstacles to a union of interests, in order to make a systematic business of exporting such productions. A few manufacturers sell their wares to some extent direct to consumers in Europe, South America, and elsewhere, without the intervention of an agent, but those who cater to the foreign trade will bear witness to the fact that the bulk of exports is made through middle-men, who confine their attention to nothing else but sending goods abroad. Whether or not this is the best plan for accomplishing the desired object we shall not attempt to discuss, but it is the one now in practice and innovations upon established customs are not easily made.

We have before us a private directory compiled with much time and effort by a gentleman in the foreign trade, which contains the names and addresses of several hundred firms and individuals in New York city alone, each of whom makes a specialty of exporting American manufactured goods to various civilized countries. One is engaged in trade with Brazil, another with Russia, another with Australia, another with two or three countries, one with almost all countries and so on to the end of the list. The names are mostly offoreign origin, and very few of them are familiar in general business circles, yet to theirefforts is due a very large part of the $7,000,000 to $7,500.000 average weekly exports (exclusive of specie and dry goods) from the port of New York. There must be particular fitness for such an occupation. If machinery is to be the specialty, the factor must have some mechanical knowledge as well as clear information about the state of progress in this line, in the country or countries where he designs to make his sales. Should he engage in exporting anything

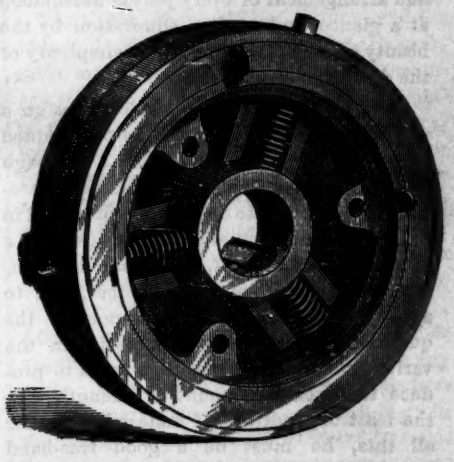


FIG. 5.

from a pin to a pile driver, or from a baby carriage to a locomotive, a more general and thorough information is necessary, as to the tastes and inclinations of the people counted upon for customers, in order to do a successful business. This qualification is none the less requisite should all exports be consigned to a well posted salesman, resident in the foreign country. Recent reports of the United States consuls to the State Department, in obedience to a letter from the acting Secretary of State, dated August 16th, 1877, calling upon them to make examination as to branches of trade with the counties to which they are severally accredited, "in which the United States may properly and usefully share," and "to advise the department when suitable occasion shall offer, as to the demand for different products and manufactured articles, now used in those countries, their nature and prices whenever they are, such as it is probable the industry of the United States can supply," have elicited much valuable information, and the complete publication of those reports will be looked for with special interest. Further reports are also to be made "from time to time," in accordance with the instructions in that letter. There is undoubtedly a good de-

FIG. 4.

mand to be obtained for American machinery and mechanics supplies, in countries where but little has been sold, when the merits of these productions shall be brought to their notice, and our manufacturers understand what is most needed in each foreign country.

402252

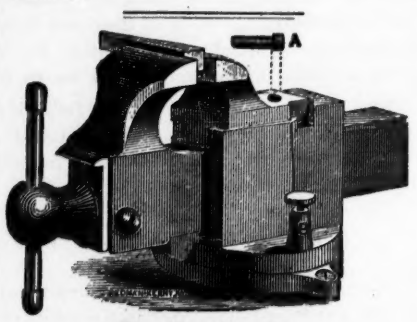
Designing Machinery.

At a meeting of mechanics in Scotland Mr. R. B. Bell delivered an address on "Designing Machinery." He noted that in early days, in designing machinery, the proportion and strength of parts to accord with the strains to which they would be subject were not so much decided by minute calculation as they were by comparison and experience. The result here was a great waste of material, placed in positions not required, as may be seen in the designs of some of our older engines and machinery. In time competition has come, and a better knowledge of the principles of design and construction, and proper calculation of the strengths and strains, and the more extensive use of malleable iron in place of cast iron, in many parts of the work, and the result has been that the framing of machinery is not now made to represent Gothic churches or Grecian temples, but every member of the machine is designed with the intention of containing only the proportion of iron due to its own requirements, disposed in such a manner as to combine all the materials in the best forms to suit the purposes intended. Attempts at architectural effect and all other unnecessary interpolations are abandoned, and the result is that in a well designed engine or tool, the eye is never offended by any unmeaning or incomprehensible member. The meaning and arrangement of every part is understood at a glance, and excites admiration by the beauty of the proportions and simplicity of the details.

In the first place, no man can design a machine in such perfection as here attempted to be described, unless he has a thorough knowledge of all the principles of the machine he purposes to design, is well versed in practical geometry and mechanics, has a practical knowledge of, and is able to calculate strengths, strains and forces, and to apply the calculation to apportion the quantity and form of the material in the various parts of the machine, so as to produce the greatest amount of strength with the least expenditure of material. Besides all this, he must be a good free-hand draughtsman and have cultivated an artistic taste for form and effect; otherwise, although, from possessing all the other qualifications, he may produce a machine perfect in all its working parts and properly proportioned, yet, for want of such a faculty, his machine will turn out stiff and ungraceful, and wanting in form and effect.

It may at first sight appear absurd to say that the study of anatomy can in any way assist the mechanical engineer in designing machinery; yet, on reflection, it will be found to be a matter of no small importance. If the anatomical class and the dissecting-room are now part of the recognized studies of the artist who aims at perfection in the mere depiction of the human frame, how much more should it be his study whose aim it is to produce imitations of its actions. To exemplify this, let us consider that our whole aim, in the study of mechanical appliances, is to be able to design works which will simply exaggerate the power which we possess in our own bodies, so as to concentrate the power of thousands into a unit, and to create of ourselves automatons in brass and iron, to imitate the actions which are performed by the body of man himself. The human machine can dig the ground, can hammer iron, can spin, sew, weave, propel boats, lift weights, carry itself, or carry loads from place to place by land or water, can burrow deep into the bowels of the earth, and fetch water and minerals to the surface—all this can it do of itself, and has done, without the aid of machinery.

To effect this by machinery, we, in our rude way, imitate nature as best we can, supplying the places of bones and joints, muscles and sinews, hands and feet, by shafts and rods, levers, straps and bands, wheels, cranks and connecting-rods, all of which in endless combination are required for the purpose of producing what the legs and arms and hands and feet of man effect by the admirable system of natural appliances with which they are furnished, while the system of the human body in giving power and vitality to its members is copied by the steam engine and its generator; and what, after all, is the appearance of the most perfect of man's combinations of machinery in comparison with the perfection of the human machine itself? Therefore the study of the human body, which in itself is the greatest perfection of a mechanical machine that it is possible to conceive, should be a part of the education of the mechanician. The beautiful mechanical arrangements with which it is furnished, the manner in which they are put together, and the forms into which they are molded, are all studies which are well worthy of the investigation of the mechanic. Let us take, for example, the arm and hand of man, so accurately proportibned in the strength of their various parts, so wonderfully shaped for the multifarious duties they have to perform, and with all this adaptation to every conceivable requirement for which their services may be demanded, yet so beautiful and graceful in their form and proportions. It cannot, therefore, be amiss in us, as part of a liberal education, to include the study of that which it is our main end to imitate, and yet which, with all our efforts, we can never equal. Then, we are justified in saying that the study of anatomy is not foreign to the requirements of a cultivated mechanic. What has been said of anatomy applies equally to natural history, in fact, to everything that has life and motion.—*Manufacturer and Builder.*



The Prentiss Vise.

In most adjustable jaw vises, some portion of its efficiency or durability is sacrificed in order to develope the adjustable feature. The accompanying illustration represents a new style of adjustable jaw vise, combining strength with convenience, and is a departure from the general devices heretofore in use, to accomplish the adjustment, inasmuch as both jaws are solid where they clamp the work. The back jaw is adjustable, and in use, instantly conforms by automatic action, to any angle, making firm the object held, whether it be straight, beveled or wedge-shaped. If desired, by inserting the pin A, shown in the cut, the jaw becomes fixed, and immovable, thus making a perfect parallel or solid jaw vise.

The adjustable jaw resting and working as it does against a solid body of the vise is thereby absolutely rendered as strong and durable as the old style permanent jaw. B, means of a new patent swivel bottom this vise may be readily adjusted to any angle, right or left, at will of operator, by simply raising ratchet pin B, as seen in cut, which, on being freed, is instantly forced home by a spring, rendering the vise solid and firm as if stationary.

The mechanism of the patent swivel base is such as to render it fully as strong as the stationary or solid bottom, capable of carying the heaviest class of work and resisting the *shock of chipping*, having been devised and constructed with particular reference to the class of work carried on in large establishments.

This makes it well adapted to machine shops. One style is made without the swivel base. Every Prentiss vise is complete in itself, with no complicated gear or extra attachments. Simplicity is one of its distinguishing features. They are adapted to all classes of business in which such an implement is required to be used, and from its construction has but little liability to get out of order. The Prentiss vise is manufactured by Hall Manufacturing Company, 23 Dey street, New York.

Business is good at the boiler works of George Miles, South Boston. He has lately constructed an oil still of 600 barrel capacity, being the largest ever built east of New York. He makes an improved self-balancing furnace door, by means of which access to tubes for cleaning is made easy.

System in the Shop.

In how many shops do we see tools of the most costly description thrown around the bench as though they were so many pieces of old iron. The first thing apprentices should be taught is the proper care of tools. Often more time is consumed in hunting for a tool thrown aside carelessly than it takes to do the required job after it is found. Every shop should have racks or cupboards to keep small tools such as taps, reamers, drills, and mandrels, and the workmen should be given to understand that these are to be carefully cleaned and returned to their places after using. In almost every large shop there is a tool room and a tool keeper whose duty it is to look after the tools and check them out to workmen. As a general thing he is also provided with a lathe, which should be of the most approved construction, and a universal milling machine with which he can make and keep in repair all tools and fixtures. Lathes, planes, and other machine tools should be taken apart frequently, thoroughly cleaned, and repaired. The time spent in so doing is amply repaid, as journals or other wearing surfaces are often found to be grinding, and would without such attention become badly worn before their condition would be noticed.

Belting should never have more than one lacing; should it be necessary to lengthen a belt it should be skived and cemented. Planer bolts should be squared under the head to prevent the bolt ways in the platen from becoming bruised; the nuts should all be of one size and case hardened. Grindstones should be kept trued and never run in the water. A good plan is to have the water in the trough within about an inch of the stone and have half-a-dozen wooden balls of three inches diameter floating about; these will be kept in motion by the stone, and will supply what water is wanted. This prevents the floor from being always wet and dirty.

Polishing on an engine lathe should never be allowed unless it is absolutely necessary, a speed lathe being better adapted to this purpose besides being less expensive.

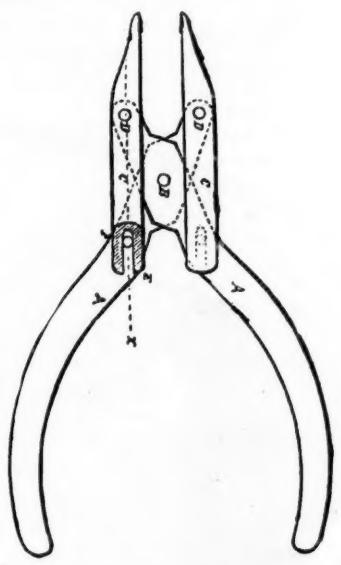
All machine tools are made with greater precision than they were a few years ago, and therefore require better care. The writer has been in shops where tools from good makers that were new less than ten years ago, are today worthless as far as doing good, accurate work is concerned. A good lathe or other machine tool ought with care to last a lifetime. Dies and drills can be bought cheaper than they can be made, and more perfect than the average toolmaker can make them. With the aid of the most approved machinery taps are now made so perfect and at prices so low that it is very poor economy for machinists to attempt to make their own.

In fitting out a shop with new tools, or in the purchase of any machinists' tools, the cheapness alone should not govern the purchaser, as often a tool costing a few dollars more is worth double that of the low-priced article. Never buy of a maker unless he is well known and has a reputation that he cannot afford to lose. The writer once fitted up a shop with tools from a prominent company of machine tool builders with the exception of two lathes which were bought of another party because they were cheap. After five years' use the two lathes had cost more to keep in repair than twice what the entire lot of twelve machines of the other makers had cost during that time. Drawings of machinery or parts should be glued to a light board and varnished over with shellac, and after using should be carefully laid away and numbered. It is well to add here that no machinery should be constructed without good working drawings, as it is easier to build the first machine on paper than in metal. It is of great importance every thing in the shop should be kept neat and clean and at all times ready for "business," as those who have work to be done seldom fail to find the shop where everything is kept nice and tidy. * *

It is told of a popular Saratoga hotel proprietor that, while going down to New York on one of the Troy steamers the other night he mistook the steam gauge in the engineer's room for a clock, and accordingly adjusted his valuable Jurgensen to 120 pounds pressure. We understand that the strain proved too much and that the watch is now undergoing repairs.—*Saratogian.*

Parallel Pliers

Almost every machinist knows by experience, that it is next to impossible to get a firm hold upon work with the old fashined pliers in general use. The tendency of any article fastened upon is to slip outward, the pressure being exerted in that direction, in conformation with the shape of the jaws. The parallel pliers shown herewith, are designed to obviate this difficulty. The pliers consist of four distinct parts, the two jaws C, and two handles A. The handles are pivoted at the point B, and close the jaws by pin connections at the point D. There is, however, in addition, a guide pin in each handle on the other side of the point B, and at the same radial distance from it as the points D. As each pair of pins lie in a horizontal line x x, parallel to the other pair, and as all four pins are equally distant from the central pivot they approach the center line, when the handles are closed, with the same angular velocity, and maintain the parallelism of the jawe in every position. The guide pins move in slots, and thus furnish an adjustment for the increased or diminished distance between the pins, arising from the approach or recession of the jaw.



Any object from a sheet of paper thickness up to the full capacity of the jaws, can be grasped firmly and with a direct uniform pressure, therefore a greater amount of power can be applied to the handles with safety than with the old tool. While increased strength forms one of its distinguishing features, the same power exerted gives a much securer grip than with ordinary pliers. The article grasped is kept from sliding about, which would not be the case were there only one point of contact.

With the same width of opening of jaws, this improved tool has a greater range of grasp, for pliers of the common form have a tendency to thrust an article outward from their hold when opened to any extent, for the reason that the angle becomes very great. For holding fine work, jewelry, watches, and the like, these pliers are well adapted, for the reason that the extended bearings avoid concentration of pressure at any one point, and thus prevents defacing the surface of the work. The parts of this tool are drop-forged of best steel, afterwards milled and shaped to standard gauges by the duplicating system. so that any piece injured can readily be replaced, as well as insuring accuracy of fit. The manufacturers are Hagstoz & Thorpe, Philadelphia.

Skilful Penmanship Practically applied to Business.

By the introduction of the various photographic methods of reproduction of pen-drawings, the skilful pen artist has gained a widely extended field of labor. His drawings are at once transferred, by photo-engraving, to relief plate, for common printing, or to stone for lithography. Among the most noted and successful workers in this line is D. T. Ames, artist penman, 205 Broadway. We have seen many things reproduced from his pen work that were surprising exhibitions of accuracy and good taste, among which are the headings of the MACHINIST, letter and bill headings, business cards, certificates, checks, drafts, &c., the latter actually rivaling in accuracy and elegance steel engravings, while being upon relief plates their advantage for convenience and cost of printing is very great.

Taps and Screw Threads.

The manufacture of taps and dies, for general use, has undergone some importan changes since the "U. S Standard" thread was originated, some time during our late civil war. It was formerly the custom in every large shop to make all the taps used on the premises, and the differences of gauge adopted by the various shops was a constant source of annoyance and complication. Nuts often had to be re-cut, and the expense, waste of time, and uncertainty entailed by this lack of a uniform system of screw threads was so great that the Association of Mechanical Engineers agitated the subject of a uniform standard, at their annual meetings, for several successive years. To some extent this difficulty still exists, but much progress has been made and it now seems to be only a question of time when a system of gauges of uniform measurement, for the whole country, shall be adopted, One important step towards this desired object is the invention of ingenious tap cutting and threading machinery, in which three or four prominent establishments have striven to excel each other and produce a better quality of taps and dies, and at a lower price than has heretofore been possible. The different styles of thread, called "Standard" are two in number, viz: the Franklin Institute or U. S. and the Whitworth. The former was introduced by Mr. William Sellers, who, in explanation, read an essay before the Franklin Institute, April, 1864, on a system of screw threads and nuts, The latter was adopted years ago in England by the engineers of that country, and is now in universal use there.

The sharp V thread is generally used by mechanics in our country. We quote from the essay above cited:

"The form of thread adopted by the English engineers is one with flat sides, at an angle to each other 55°, with a rounded top and bottom. The proportions for the rounded top and bottom are obtained by dividing the depth of a sharp thread having sides at an angle of 55° into equal parts, and within the lines formed by the sides of the thread and the top and bottom dividing lines, inscribing a circle which determines the form of top and bottom of thread. Judging from the practice of this country, the English form of thread has not met with the same favor that has been accorded to their pitches. Its advantages over the sharp thread are, increased strength to the screw from the abscence of acute corners, and the greater security from accidental injury, which the rounded top possesses. Its objectional features are, first, that the angle of 55° is a difficult one to verify; it is probable, no gauges to this angle, made independantly of each other and without special tools, would correspond with sufficient accuracy. Secondly, the curve at the top and bottom of the thread of the screw will not fit the corresponding curve in the nut, and the wearing surface on the thread will be thus reduced to the straight sides merely. It is not to be inferred from this that these curves cannot be made to fit, but only that the difficulties in producing contact are so much increased by the peculiar form, that in practice it will not be accomplished. Thirdly, the increased cost and complication of cutting tools required to form this kind of thread in a lathe, it being requisite that this tool shall have at least three cutting sides, in order to form the round top between two of them. The English practice for small work, is to rough out in a slide-lathe, with a single-point tool having sides of the proper angle, and finish in a hand lathe with a comb chaser, which has been dressed to the proper form upon a hob kept for that purpose, requiring three kinds of cutters and two lathes to perform what with our practice requires but one cutter and one lathe. On large work, the screw is finished in the slide-lathe, with a chasing tool dressed to the proper form upon a hob; and as these hobs are necessarily the standards of form until worn out. it is fair to suppose the shape must be undergoing a continual change. The necessity of guarding the edge of the thread from accidental injury, becomes more and more apparent as the size of the bolt is increased, and we have recognized this by finishing such bolts with a small flat upon the top of the thread; but no plan has been proposed for general adoption upon all screws, nor have any proportions been suggested where a flat is desired, or where from the size of the bolt it would seem to be necessary. As it is very desirable that some uniform rule should be observed in the formation of all threads, and as the sharp top is objectionable upon large screws, this form must be abandoned if we would accomplish our object. It being conceded that the flat angular sides are necessary, we have only to choose between the rounded and flat top; and having examined the former, it only remains to notice whether the flat will be found free from the objections urged against the round. As the sides of the thread are the only parts requiring to be fitted, and as these are of the same shape as the sharp thread, the one will be as easily made as the other. The width of the flat top will be determined by the depth to which the thread is cut, so that the same tool can be used in both cases. The flat on the top of the thread being required to protect it from injury, it is evident a similar shape at the bottom would give increased strength to the bolt as well as improve its appearance. To give this form requires only that the point of the cutting tool shall be taken off and then it is evident this thread can be cut in a lathe with the same tool and in the same manner as the sharp thread."

The Sellers system or United States Standard thread, deduced from the above reasoning, is the ordinary V thread, with surfaces inclining at an angle of 60°, and with the angle cut off at the top and filled in at the bottom to the extent of one-eighth of the depth of the V thread each, so that the depth of the thread is three-fourths of the ordinary V thread form. It is the thread generally recommended by prominent machinists and engineers for universal adoption throughout this country. Believing it to be of the highest importance that such a standard should be generally recognized as soon as possible, we heartily second all efforts looking to that end.

Plumbago as a Lubricant.

The subject of friction and its reduction by the use of lubricants, is one of such magnitude and importance that it would be impossible, in the limits of our article, to more than touch upon some of its salient points, as connected with the use of plumbago. The need of lubrication began with the use of machinery, and the question of what lubricant is the best has occupied the mind of the thoughtful workman since that time, and the best efforts of mechanics, and chemists have been directed to the production of a compound possessing all the essential characteristics of a perfect lubricant. Many of the oils and greases in common use possess valuable qualities, but no one or any number, can be said to be a *perfect* lubricant, as described by Prof. Thurston. He says, "A good lubricant should have the following characteristics, (1.) sufficient 'body,' to keep the surfaces from contact under the maximum pressure; (2.) the least viscosity consistent with the requisite amount of 'body,' (3.) the lowest possible co-efficient of friction; (4.) the largest capacity for receiving and carrying away heat; (5.) a high temperature of decomposition; (6.) it should vaporize at high temperatures rather than decompose and burn on."

It is not our purpose to consider other lubricants than plumbago, except in the way of comparison, and then only of the best winter sperm oil, which is generally accepted as the standard, and as possessing more of the qualities essential in a good lubricant than most others. The occasion of our article is a series of exhaustive tests made at the Stevens Institute recently, under the direction of Prof. R. H. Thurston, for the purpose of correcting some of the misconceptions that are held with regard to the proper condition of plumbago as a lubricant, and to determine with scientific accuracy its comparative value as a lubricant, with the various oils and greases in common use.

It has been the opinion of some scientists that plumbago should be reduced to an impalpable powder for use as a lubricant, and that when used in the form of flakes that its value is only developed by the grinding on the bearing. Tests were made with plumbago of different degrees of fineness from coarse flake to an impalpable powder, all selected with the greatest care to ensure their absolute purity. The coarse flake showed considerable value, but increasing in value until a fine flake entirely free from powdered plumbago was reached, at which point the best results were obtained. Chemically pure plumbago, ground to an impalpable powder, tested under a total pressure of 180 pounds, gave the astonishing result of holding the bearing as in a vise.

RESULTS OF THE TEST.

335 miligrams of best winter sperm oil under a pressure of 48 lbs. per square inch, ran 11 minutes 2000 revolutions per minute, having traveled by rubbing surface, 7,198 feet. The elevation of temperature was 175° F.; the average co-efficient of friction .0555.

A mixture of 120 miligrams of fine flake plumbago (absolutely pure) with sufficient distilled water to make it adhere to the bearing, under 48 lbs. pressure per square inch, ran 30 minutes 2000 revolutions per minute. traveling by rubbing surfaces, 19,635 feet. At the eleventh minute, when the life of the oil was spent, the co-efficient of friction was .0417, and the increase of temperature 158° F. The average co-efficient was .0596, and the total increase of temperature 194° F.

335 miligrams of best winter sperm, under a total pressure of 60 pounds. 2000 revolutions per minute ran 51 minutes, having traveled by rubbing surfaces 33,360 feet with an increase of temperature of 185° F. The same quantity of plumbago grease, which contained but 15 per cent of fine flake plumbago under a total pressure of 60 pounds, at 2000 revolutions per minute, ran 293 minutes, having traveled by rubbing surface 194,941 feet. At the expiration of the 51st minute, when the oil had been spent, the increase of temperature was 135° F.; at the 103d minute, the temperature was 130° F.; at the 155th minute, 142° F.; at the 205th minute, 182° F.; the total increase was 310° F. at the end of the test. An examination of the bearing at the end of the test, showed it to be in perfect condition. It may be well to mention, that in other trials when the temperature reached was very high, that where plumbago was used there was no cutting. It may be proper also to mention that a test made with the grease which was the base of the plumbago grease, gave no better results than the sperm oil.

The results of this test will go far to establish the relative value of plumbago, as compared with oil or grease. F. W. P.

American Institute Fair.

The machinery department of the American Institute Fair is full of exhibits, but the general character of the display is far below what it has been in former years. With the exception of a few small lathes and two shaping machines, there are no machinist's tools to be seen. Somewhat more than the usual number of novelties are set forward, few of which possess any striking merit. Small power steam engines and hot air engines are the most prominent articles in this department, and they are well worth studying, though we have not space to give a full description of any of them.

THE NEW YORK SAFETY STEAM POWER CO.

have in operation a new style of horizontal engine, built for 20 horse-power, but which is running steadily at 35 horse-power speed. Its particular feature is a piston valve, by means of which steam is economized. In external appearance this engine is attractive, being well proportioned and finished in good taste.

THE STOW FLEXIBLE SHAFT

is an article of peculiar value in many shops, as it transmits rotary motion to any desired distance from the source of power and through any number of cunes. In iron drilling or surfacing, polishing, cleaning castings, and emery grinding of almost any kind, it can be employed to advantage.

A NOVEL STEAM BOILER

is brought forward for inspection by Mr. John Hughes, of Harlem. It would seem to be impossible to invent anything new and striking in boilers after so many original ideas have taken shape in that direction, but this has features unlike any other boiler we have seen. In its interior construction it is combined, horizontal and vertical. It is 36 inches long, 36 inches wide, 40 inches high, and has 5¾ square feet of grate. The main feature is its extensive heating surface for one of small size. It would be likely to get up steam very quickly and to stand a great pressure. The design is to have only 5 or 6 inches depth of water over the fire.

EDWIN HARRINGTON & SON

make a display of portable screw hoisting machines. The screw and main wheel are encased in a tight box and kept free from dirt. The screw is kept running in oil, and heavy weights can be lifted by hand with comparative ease. One of their 1000 pound hoists lifted a 1650 pound weight without difficulty.

OLIVER'S LATHE DOG,

or "Clamp Carrier," is a new invention placed on exhibition. Its peculiarity consists in having swiveling jaws that adjust themselves to tapered or irregularly formed work, without extra strain upon the screws. Oliver's "Ring Carrier" and "Angular Lathe Carrier," are also new articles for machinists, and have special improved construction.

THE VICTOR CHUCK AND MICROMETER CALIPER,

shown in a case, are fine tools for progressive machine shops. This chuck is a departure from the ordinary styles previously in use. It is adjustable, self-tightening and the clutches are flush with the face, thus giving less difficulty in adjusting the drills as well as increased durability. In well regulated machine shops, the micrometer caliper is coming fast into general use, and is destined to take the place of ordinary calipers, where accuracy and close work are required,

The Union Stone Co., of Boston, and the Celluloid Emery Wheel Co., of Newark, make exhibits of practical interest to machinists. Probably nearly all of the well appointed machine shops, throughout this country, have had emery wheels in use at some time or other, but many of the number are not now using them. The reason they are not more universally used, seems to be that nearly every wheel is open to objections that in time lead to its condemnation by some, while to others it may be perfectly satisfactory. After a man has tried one wheel, with poor results, it is hard to persuade him to try any other. One common objection is the scattering of emery dust over other machinery in the same room where the wheel is used, damaging fine parts and movements, another is liability to go to pieces with disastrous consequences, when run at high speed; another, liability to gum, and another the bad influence of heat and moisture on their working qualities. When we come to add that many machinists will not give special attention to learning the proper care and use of an emery wheel, there need be little wonder that so large a proportion of them are contented with the grindstone and file. Much progress in making and introducing emery wheels has been made within the past few years and much is yet to be made. A Celluloid wheel is constantly running in water, and is part of the time in use. Its efficiency does not seem to be impaired by the bath. We saw one of them ¼ by 12 inch thrown forcibly upon the floor without breaking. A Celluloid wheel was shown, ⅛ by 9 inches, on which over 50 pieces of saw steel (14 gauge) had been notched half away. These notches fitted to the wheel as true as a piece of work to a gauge. The corners of the wheel seemed to be not in the least rounded off. The large sized thick wheels of this kind are made by placing two or more thin wheels together, and cementing with spirits of camphor. This, it is claimed, keeps the middle of the wheel of the same hardness as the edges, so that it will wear uniformly. The Union emery wheels are made in ten different grades, and cut well, even at a low rate of speed.

THE COST OF THE RAILROAD STRIKES, in the State of New York alone, simply for the pay, subsistence and expenses of the militia called out to preserve order, is reported by the Adjutant General to have been about $250,000. Add the damage to property by delays and malicious destruction and the total will amount to something formidable, and that in a State where the troubles were less serious and lasted a shorter time than in two or three other States. The bill in Pennsylvania must have been many times as great, and adding New Jersey, Maryland, Ohio, Indiana, Illinois and Missouri, the total would make a somewhat formidable figure even in a war budget, to say nothing of the income or even the capital account of a great railroad company.—*Railroad Gazette.*

Wire-Drawing.

BY PROF. R. H. THURSTON,
OF THE STEVENS' INSTITUTE OF TECHNOLOGY.

As small rods cannot usually be reduced to the sizes distinctively classed as *wire* in the rolling mill, it is generally produced by the the process known as *wire-drawing*. The larger sizes (above ½ inch diameter) are, however, often rolled and especially where the iron is of too poor quality to permit it to "draw."

In ancient times (B.C. 1500) wire was made by hammering the metal into thin plates and cutting from these plates very narrow square wires, which were subsequently hammered into cylindrical form. Wire was also (B.C. 800) drawn down under the hammer directly. As early as the beginning of the fourteenth century it was made by drawing through draw-plates.

Accounts of wire-drawing machinery appeared two centuries later in Germany, and it was adopted in Great Britain as early as the middle of the seventeenth century, where it gradually displaced the older method of production by hand, which was already giving employment to many workmen.

The "billet" is prepared for wire-drawing with exceptional care, and must, for small sizes particularly, be of the best obtainable metal. Ordinarily good iron will draw down to No. 14 (0.083 inch), and very good iron will draw to No. 25 (0.02 inch), but only the finest known iron can be drawn as fine as Nos. 30 to 36 (0.012 to 0.004 inch). Fine wire is made from selected scrap, or from the best grades of charcoal iron. In preparing the billet the scrap iron is melted down in a charcoal fire under a strong blast, and worked into a compact and homogeneous bloom. The bloom is hammered, reheated in a reverberatory furnace, again hammered, and finally rolled into rods. These rods are cut up, piled, reheated, and again rolled, the final product being wire-rods. The rolls used are from 8 to 12 inches in diameter, the former being used principally in the United States and the latter in Europe. The former are driven at the rate of 450 to 500 revolutions per minute.

The rate of reduction is determined by the relative sectional area of the wire-rod and the billet, and their areas form the extremes of a geometrical series of which the rate of reduction between successive passes is the ratio. Thus—

$$N-1=\frac{\log A-\log a}{\log r} \quad . \quad . \quad (1.)$$

in which N is the number of grooves, A and a respectively the areas of the first and the last, and r is the ratio.

Where A =2.28 square inches a=0.06 square inches, and r=1.3, N becomes 15, which represents good practive. About 0.02 is allowed for the shrinkage in area of iron in cooling from the rolling heat to the temperature of the air.

The area of each groove is obtained by multiplying the area of the adjacent groove by the ratio of reduction.

In rolling, when the shape of cross section is changed from one simple form to another at each pass, the reductiion is effected with greater economy of power. In rolling wire-rods, therefore, the shapes of grooves are made alternately square and oval, oval and round, feathered and square or round, until the finishing grooves are reached which give the rod its proper cylindrical form.

The finished wire-rods are reeled up as they leave the mill, and the coils are taken to a forge, where the ends are made tapering, that they may readily be entered into the draw-plate and pass through so far that the point may be seized by the nippers or "grippers" by which they are to be drawn. The surface of the metal is cleaned thoroughly by immersion in dilute sulphuric acid and by subsequent washing, and is then coated with a coating of lime-water or other alkaline wash to prevent oxidation during the operation of drawing.

The wire is then drawn by passing it through draw-plates or die-plates, of which the holes are made smaller and smaller until the wire is given the required size. As the metal is hardened by the process it is annealed occasionally—usually after reduction two or three sizes—in annealing pots heated to a dull red heat, and by subsequent very slow cooling. A slight expansion takes place during this operation. The protecting coating must be renewed as often as it is removed by this process. To prevent oxidation while annealing, the wire is sometimes heated in a non-oxidizing atmosphere, or in presence of some flux.

The draw-plates or die-plates are blocks of cast-steel perforated with conical holes carefully gauged, the smallest diameter of each being that of the wire to be drawn from it. These holes are frequently gauged by the workman, and when worn the metal is hammered around the small end of the hole to close it up and then carefully reamed out to size again. The taper of these holes is best made slight, as in Fig. 1.:

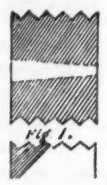


Fig. 1.

The wire blocks or wire-drawing machines consist of a substantial bench on which is mounted a strong cast-iron drum ordinarily about two feet in diameter for No. 10 (0.13 inch) wire, on which the wire winds as it is drawn through the plate. This drum is turned by a vertical spindle two inches in diameter, on which it is mounted, square projections on a cam mounted on the spindle entering recesses of similar form in the disc which forms the bottom of the drum. This cam or cross-head which drives the drum is carried by a square portion of the spindle which passes through a hole in the cam. When the drum is raised far enough to clear the projections which drive it, it turns freely on the spindle, and can be rotated either forward or backward. A set of levers keeps the drum in any desired position, either engaged with the driving lugs or above them where it may be conveniently turned or stopped at will. These levers are worked by the foot.

The vertical spindle is driven by a horizontal shaft and bevel gearing, and the latter shaft by pulleys belted from the line-shafting.

The draw-plate is mounted on the bench in a frame strongly bolted down to the table.

The coil of wire to be drawn is mounted on a reel conveniently placed, and the end of the point tapered sufficiently is carried through the plate and seized by "nippers" or "grippers" attached to the driving cam.

The spindle being set in motion, the wire is drawn through the die-plate far enough to permit of its being securely clamped to the drum. It is then released from the nippers and made fast to the drum, which is then set in motion and the coil is drawn through the plate, winding on the drum as it issues, and is then one size and sometimes two sizes smaller than before.

The movement of resistance in drawing No. 10 to No. 11 (0.134 inch to 0.12 inch), is about 350 foot-pounds; the velocity of the wire is about 250 feet per minute. Larger wire is drawn on drums of one or two inches diameter and at lower speeds, reaching a minimum of 150 feet per minute. Smaller sizes are drawn on drums of 22 inches or less diameter, and at speeds running up to 500 feet per minute.

The resistance offered by wire in passing through the draw-plate varies with the size of wire, character of metal and arrangement, proportions and management of the wire-blocks. Good metal under ordinarily good conditions requires, to reduce it one size, from 100 pounds with the finer to 1,000 pounds of the larger grades.

The ratio of reduction of area of section is usually about one and one-third to one.

An approximate value for good wire is obtained by the equation—

$$P=\frac{30}{0.250-d} \quad . \quad . \quad . \quad . \quad (2.)$$

in which d is the diameter of the wire in inches.

The velocity of drawing is approximately

$$V=25\ N,$$

where

N= the number of the wire.

The power demanded is therefore

$$\frac{PV}{33000}=\frac{750\ N}{33000\ (0{,}250-d)} \quad . \quad . \quad (3.)$$

In drawing down billets the heaviest work and greatest reduction of size take place in the "roughing" or "nipping" blocks, and no special attention is paid to the size or to gauging. The last drawing is done in the "finishing blocks," and the wire is carefully drawn precisely to gauge.

In "wet drawing" the metal is drawn directly from the lees-tub in which it receives the alkaline coating, and the wire is thus preserved from oxidation, as is also the draw-plate, and is at the same time lubricated. Lime-coated wire is drawn through grease. Bright wire is drawn dry.

Wire is often "coppered" by drawing it through a bath of solution of copper sulphate, or is tinned or "galvanized" by leading it through a bath of tin or of zinc kept a temperature slightly above the melting point, to the finishing block.

When finished, sizes 0 to 20 are made up into "bundles" weighing 63 lbs. each, and smaller sizes into "stones" of 12 lbs. each. The smallest size ordinarily met with is No. 36 (0.0050' inch diameter), but No. 40 (0.003144 inch diameter) has been made.

Wire is gauged by the "Birmingham Wire Gauge" in Great Britain, and sometimes by the "American Gauge" in the United States. The following tables indicate the values of the standard numbers:

Number of Gauge	Diameter Birmingham Gauge		Diameter American Gauge.	
	Inches.	Millimetres.	Inches.	Millimetres.
0000	·454	11.532	·46	11.684
000	·425	10.795	·4069	10.336
00	·38	9.6519	·3648	9.266
0	·34	8.6359	·3248	8.2511
1	·3	7.6199	·2893	7.3481
2	·284	7.2135	·25763	6.5437
3	·259	6.5785	·22942	5.8272
4	·238	6.0451	·20431	5.1894
5	·22	5.588	·18194	4.6212
6	·203	5.1562	·16202	4.1152
7	·18	4.572	·14428	3.6647
8	·165	4.191	·12849	3.2636
9	·148	3.7592	·11443	2.9065
10	·134	3.4036	·10189	2.588
11	·12	3.048	·090742	2.3048
12	·109	2.7686	·080808	2.0525
13	·095	2.413	·071961	1.8278
14	·083	2.1082	·064084	1.6277
15	·072	1.8288	·057068	1.4495
16	·065	1.651	·05082	1.2908
17	·058	1.4732	·045757	1.1495
18	·049	1.2446	·40303	1.0237
19	·042	1.0668	·03589	·9116
20	·035	·88899	·031961	·8118
21	·032	·81279	·028462	·7229
22	·028	·71119	·025347	·64381
23	·025	·63646	·022571	·5733
24	·022	·55879	·0201	·51054
25	·02	·508	·0179	·45466
26	·018	·4572	·01594	·40487
27	·016	·4064	·014195	·36055
28	·014	·3556	·012641	·32108
29	·013	·33096	·011257	·28593
30	·012	·3048	·010025	·25463
31	·01	·254	·008928	·22677
32	·009	·2286	·00795	·20193
33	·008	·2032	·00708	·17983
34	·007	·1778	·006304	·16012
35	·005	·127	·005614	·14259
36	·004	·1016	·005	·127
37	·	·	·004453	·11311
38	·	·	·003965	·10071
39	·	·	·003531	·08969
40	·	·	·003144	·07986

The process of rolling and of wire-drawing greatly increases the strength of iron. Good iron which in round bars two inches in diameter has a tenacity of 54,000 pounds per square inch, when rolled into one inch rods often attains a strength of 60,000 pounds. When drawn into No. 10 wire (0.134 inch) its strength becomes about 90,000, and Nos. 15 and 20 (0.072 and 0.035 inches) respectively have a tenacity of about 100,000 and 110,000 pounds per square inch. A wire ⅛-inch in diameter is ordinarily expected to sustain 1,000 pounds, and one of one-thirty-second inch diameter should carry 100 pounds.

In wire mills great skill and judgment are necessary in choosing good metal and in preserving its excellent qualities throughout the processes of reduction in the rolling-mill and in drawing.

Good iron for fine wire must be pure, free from cinder, strong and ductile, and probably must have a comparatively low elastic limit.

It has been observed that of two irons selected, both having great strength and ductility, that which stood lowest in *both* respects would draw into the finest wire. The only peculiarity detected by the author in this case was a comparatively low elastic limit, as shown on the automatically-produced strain-diagram.

Charcoal bloom-iron is usually found best adapted for wire drawing.

Some excellent metal has been made by the Bessemer and Siemens-Martin process for wire of sizes exceeding No. 10.

Plumbago Oil Can

The value of pure plumbago as a lubricator, has induced much study and effort in devising ways for its convenient and effective application to machinery. It can easily be mixed with oil, but to maintain a proper proportion between liquid and solid constituents has been difficult. A common method of application has been to mix with solid or semi-liquid fats, oils or soaps. For rough purposes, like greasing wagons, these pasty substances answer well enough; the difficulty is, they are not easily introduced through the ordinary channels provided in well constructed machinery. In fine machinery the prevention of friction depends largely on the constancy and regularity with which the lubricator is applied. This was very clearly proved by Morin, in his experiments on friction, in which it was shown that continuous lubrication with the same lubricator, reduced the friction to one-half what it was with occasional lubrication. Where solid lubricators are used, this continuous lubrication is almost impossible; the solids must be mixed with the liquids at the moment of application, if we would use the two together. The accompanying

engraving shows a very nice device for effecting this. It consists of an oil can, in which is a central spindle carrying at its lower end a set of oars, resembling in form and arrangement the blades of a screw propeller. The spindle is easily rotated by the handle outside the can, which carries a bevel wheel, working into another bevel wheel, attached to the spindle. A bar or lever passes across the lower part of the can, and rests against a button attached to the elastic bottom. This bar terminates in a curved handle, which is easily pulled up by the fingers and thus affords unusual power for pressing in the bottom and drawing out the contents of the can. It is designed to use a mixture of fluid oil and plumbago. The can is manufactured by the American Graphite Co., New York. With each oiler is furnished an ingenious funnel, to take up, measure and feed into the can from one-quarter of an ounce to one ounce of plumbago at a time.

We should be obliged to any of our readers when communicating with any advertisers in the AMERICAN MACHINIST to mention where they saw their business announcement. This will not only be a favor to us but also a favor to the parties addressed, especially at the outset of our career as an industrial newspaper.

The Paris Exposition.

The tardiness of our government in accepting the invitation of France to take part in the International Exposition of 1878, is discreditable to the enterprise of this great, wealthy and progressive nation. England, our most formidable competitor in the markets of the world, has been foremost among the nations of Europe in making preparations to suitably display her productions at this forthcoming assemblage of the best creations of art, science, and industry from every civilized quarter of the globe. The people our country, whatever may be the disposition of those who represent them in Congress, are fully alive to the importance and advantages of entering the lists as participators in the largest and, we have reason to expect, the grandest Exposition ever held in the world. This fact is evinced by the applications for space by citizens of the United States, already numbering over 1500, registered through General Noyes, our minister to France.

We learn that M. Coudert and the Count De Chambord (French commissioners) have given assurances that Americans shall have space to exhibit, even though our government does not formally accept the invitation. There is no reason to assign why the small appropriation now before Congress, recommended in the President's message of October 15th, should not be promptly passed, as the time is far advanced for completing the arrangements necessary to a successful representation of American products. While waiting for govermental action, time can be gained by making ready goods to be displayed, and filing applications for space with the American minister at Paris. When it is remembered that all the space yet allotted to this country is only about 585 by 350 feet, and that applications for space already filed, nearly cover the whole of this area, it will be seen that no time should be lost in deciding to secure space for individual exhibits. The manufacturers of machinery and shop tools, and to this class the AMERICAN MACHINIST especially addresses itself, are urged not only by self-interest, but by national pride, to send over their best and most improved pieces. The favorable impression begotten in the minds of Europeans visiting our Centennial, regarding the superiority of American machines and tools, which has since taken form in increasing exports of the same, should be strengthened and extended, and the Paris Exposition offers the most effectual way of doing this. Rapidly expanding internal business interests rendered our mannfacturers, in years gone by, very indifferent about opening new markets abroad until depression in trade caused stocks to accumulate, prices to decline, and reduction of working force and working hours a necessity. Then did the value of foreign markets stand out in bold relief. Whether the old time prosperity is to return sooner or later, our manufacturers recognize, more than ever before, the importance of enlarged foreign outlets for their surplus mechanical productions.

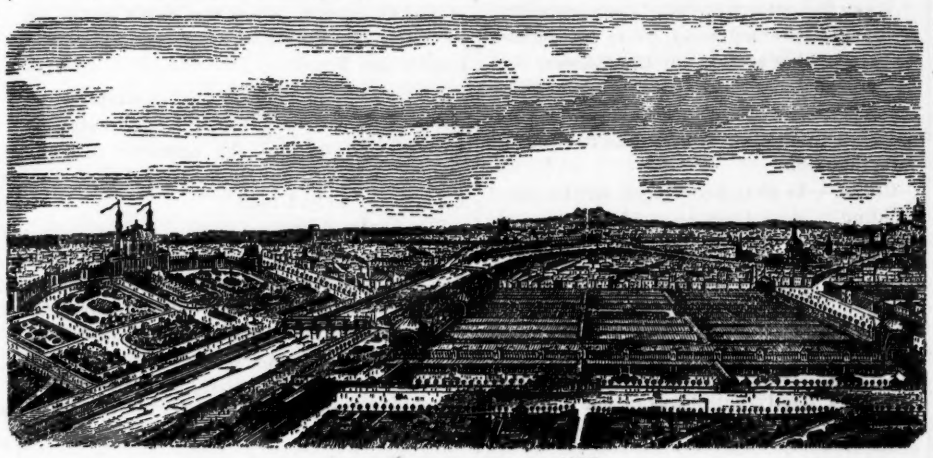
We present herewith a miniature view of the Exposition buildings as they will appear when completed. For the engraving we are indebted to Messrs. De St. Martin & Thatcher, 287 Broadway, who represent many American exhibitors, receiving and forwarding applications for space, and supplying information free of charge. On the right are shown the main buildings, all under roof, 2,400 feet long and 1,600 feet wide. On each of the two outward sides at right angles to the river, and running the whole length of the immense structure, galleries 120 feet wide are for agricultural implements. Next to these, on each side, also running the whole length, are the machinery galleries 175 feet wide. Steam will be supplied by four hugh boilers, two on each side of the building. On the left, across the river, are seen the heights of Trocadero, presenting a grand semi-circular building enclosing beautiful parks and gardens, for the reception of living animals, and growing plants. All the buildings are now under roof, and the work of construction is advanced far beyond what was agreed upon up to the present time.

We make some extracts from the general rules and regulations issued by the Minister of Agriculture and Commerce, under whose responsibility and superior direction the Exposition is placed. In each section devoted to exhibitors of the same nation, the articles exhibited will be divided into nine groups, one of which is devoted to "Tools and Processes of Mechanical Industries." The Exposition will open on the first of May, 1878, and close on the 31st of October following.

No work of art, nor product exhibited in the exhibition buildings, parks or gardens, will be allowed to be drawn, copied or reproduced, in any form whatsoever, without the permission of the exhibitor.

The Commissioner-General reserves to himself the right of authorizing the reproduction of general views.

Neither the French or foreign exhibitors have to pay any rent for the space they occupy in the Exposition. The flooring is furnished to them in a substantial condition, and ready for use, in the whole precincts of the principal Exposition building in the Champ de Mars, with the exception of the machinery gallery; and it cannot be modified, displaced or strengthened, for the necessities of installation, without the permission of the Commissioner-General, and at the expense of the exhibitors. They will have to bear alike all other expenses of arrangement, and of decorations, in the Exhibition buildings, parks and gardens.



PARIS EXPOSITION OF 1878.

Constructors of machinery necessitating the use of water, gas or steam, must declare, either at the time of making their request for admission, or through the medium of foreign delegates, the quantity of water, gas or steam they may require. Those who desire to set their machines in motion, must make known the rate of speed appropriate for each machine, and the motive power which it will require.

Water, gas, steam, and the motive power for the machinery gallery, will be furnished gratuitously

The power will be taken from the main shafting for general transfer.

The establishing of all intermediate transfers will be at the expense of the exhibitors.

Both the French and foreign products will be admitted within the inclosures of the Exposition, from the 1st of January, 1878, up to and including the 30th of March following. The inclosures of the Exposition are constituted an actual bonded warehouse, as regards custom and city dues; foreign products intended for the Exposition are admitted, under this right, up to the 15th of March, 1878

Products of all kinds must be installed, and incomplete exhibitions entirely finished, by 15th of April, 1878. This date is *obligatory*. Consequently the Commissioner-General reserves to himself the right of disposing of all space which at the date above named is only partly occupied, or entirely unoccupied, by those to whom the space had been awarded.

We give below the French law of 1868, now in force, which guarantees the right to inventions susceptible of being patented which may be entered at any exposition under government authority

ART. I. "Every foreigner or Frenchman, inventor either of a discovery or invention susceptible of being patented according to the terms of the law of 5th July, 1844; or of a trade design which should be registered conformably to the law of 18th March, 1806, or their assigns, can, if they are admitted in a public exposition authorized by the administration, cause to be delivered to them, by the Prefect or Sub-Prefect in the department or district in which the said exposition is held, a certificate descriptive of the object deposited."

ART II. "This certificate assures to the party who obtains it the same rights which a patent or a legal registration of the trade design would confer upon him, dating from the day of admission up to the end of the third month after the closing of the exposition, without prejudice to the patent which the Exhibitor may take out, or the registration which he may effect before the expiration of that term."

ART. III. "The request for this certificate must be made, at the very latest, in the first month of the opening of the exposition.

"It is to be addressed to the Prefecture or the Sub-Prefecture, and accompanied with an exact description of the articles to be guaranteed, and, if possible, a plan or drawing of the said articles.

"The request, as also the decisions taken by the Prefect or Sub-Prefect, are inscribed on a special register, which is subsequently transmitted to the Ministry of Agriculture, of Commerce, and of Public Works, and are communicated without expense to all requiring them.

"The delivery of the certificate is gratuitous."

Emigration of American Woringkmen.

Some time during the past summer, it will be remembered, a number of carpenters under contract with certain Manchester, Eng., builders and contractors, emigrated to England, to go to work in that country, with the promise of steady work for an indefinite length of time. We were convinced at the time that there was something in that transaction that did not appear upon its face. It was seized upon, however, by the free-trade school of political economists, as a very wonderful circumstance, and was made the text for many an article on the advantages of free trade, which was creating such a demand for skilled labor that even England, notwithstanding the hard times and the dulness of business, was obliged to send across the ocean for mechanics, to whom she could offer such flattering inducements that they were glad to leave this protection-cursed country and expatriate themselves in order to avail themselves of the benefits thus offered. The friends of protection to American industries were held up and pointed at as unnatural patricides, whose policy was even driving American workingmen out of the country to seek work in monarchial England.

Time, which unravels so many mysteries, has already made plain the secret spring of the above transaction. It seems that the native workmen of the Manchester builders had struck, and refused to work at the prices offered, or let others work, and to punish the strikers the bosses conceived the plan of importing workmen from this country. The Manchester (Eng.) *Examiner* says, some ten or fifteen of the immigrants were at once frightened out of their engagement or persuaded to abandon it by the striking joiners, who surrounded them immediately upon their arrival and pleaded that, though of different nationalities, they were brother workmen and should make common cause against a common enemy. The contracts under which the Americans came to Manchester, continues the *Examiner*, it would appear, were signed before they knew that any difficulties existed in the trade here. As a guaranty of their performance of the contract, each of the men surrendered to Messrs. Neill and Sons a chest of tools, varying in value from £10 to £60 ($50 to $300), and these tools are to be detained from them until they have paid their advanced passage money. If now they yield to the strikers' persuasions they find themselves deprived of their tools, unable to get a job of work at their trade, and without a cent in their pockets, three thousand miles from their homes and friends. On the other hand, if they go to work, they are hooted at on the streets and pointed out as yankees who have come to England to take the bread out of the mouths of honest British workmen. Nor is that all. Two of them have been stopped by some men, who warned them to quit work, or "take the consequences as soon as the dark nights came on."

It is not likely that we shall hear much more of the immigration of skilled labor from this country to Great Britain. The advocates of free trade will have to find some other hobby to ride in their appeals to workingmen to undertake the work of self-immolation upon the altar erected by the Cobden Club of England. It requires no remarkable powers of perception — none that even workingmen should not possess—to see the utter folly of attempting, even by force, to prevent mechanics from working a few cents cheaper in this country, while the same goods they are thus prevented from producing are manufactured in another country by workmen who receive but half or a quarter of the wages demanded, are brought here and sold, free of duty. If free trade is insisted upon in this country, it is simply that the workingmen here shall have no opportunity of dictating or advising the rate of wages their competitors shall demand.—*Western Manufacturer.*

Fitting Wheels on Axles.

On Friday afternoon, a number of colliery managers, engineers, and other gentlemen, assembled at the Bridge Street Works of Messrs. Joseph Fenton and Sons, of Sheffield, to witness some trials of their patent method of fitting up wheels and axles. A pair of 11-inch corve wheels fitted on axles, selected from a pile of some 300 sets by one of the gentlemen present, were taken up to the top of the works, at least 35 feet in height, and literally thrown down on some iron plates, without either breaking the wheels or in the slightest degree disturbing their patent fastenings, and this test was repeated half a dozen times with the same result. The next test was that of throwing the wheels and axles as great a distance as possible on the iron floor of the works, but this also was of no avail, and failed to make the slightest impression on either. Then several of the gentlemen present took their turn at them with a very heavy sledge-hammer, but a good fifteen minutes hard labor was entailed upon them before they managed to fracture one of the wheels, and this was only at last accomplished in the weakest part of any wheel—between the spokes. Other severe tests were applied which proved the specially tough quality of the steel used by Messrs. Fenton. —*Iron, Oct.* 20.

High Speed Blowing Engine.

A series of experiments have been lately conducted at the Weimer Machine Works with a short stroke blowing engine built at the establishment for the Ogden Iron Company, of Chicago. The new engine has 36-inch diameter steam cylinder, with 72-inch diameter blowing cylinder, both cylinders having three-foot stroke. Before shipping the engine, Mr. Weimer determined to test its powers to the fullest capacity, and for this purpose connected the engine with the boilers of the works, forcing the blast generated into a large air receiver especially erected for testing blowing engines. A large number of indicator diagrams were taken of both steam and air cylinders under various speeds and pressures. The air pressure was frequently run up to 14½ pounds, and the speed attained was often over 75 revolutions per minute. The friction or "lost power" was only 3½ per cent., and at times less. From 10,000 to 12,500 feet of cubic air was discharged per minute at pressures varying from six to fourteen pounds per square inch.

NEW PATENTS.

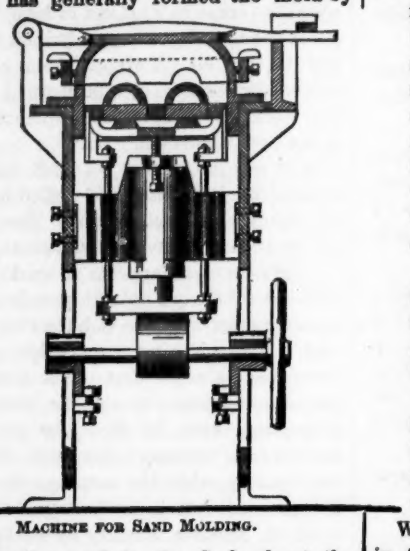
We take from the records of the Patent Office in Washington the following specifications of certain mechanical patents, lately issued, which will be found interesting:

IMPROVEMENT IN THE ART OF MOLDING SAND FOR MAKING CASTINGS.

Specification forming part of Letters Patent No. 195,071, issued to WM. AIKEN and WM. W. DRUMMOND, of Louisville, Ky.

CASE B.

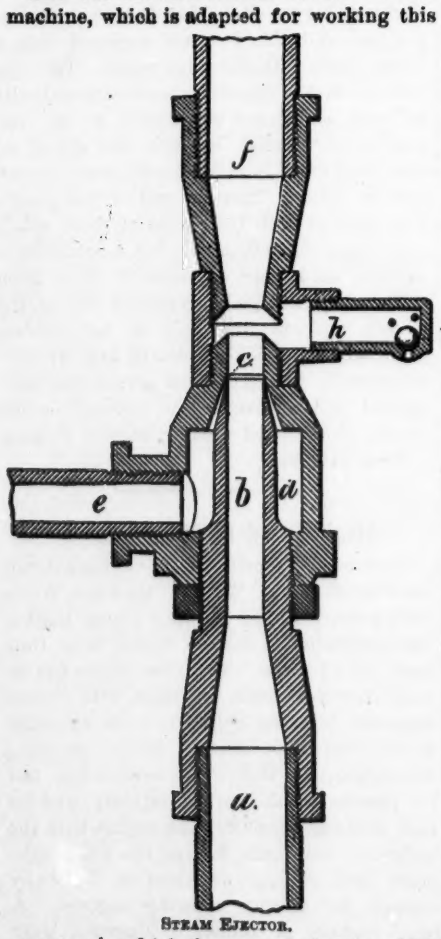
In making sand-molds for castings the molder has generally formed the mold by



MACHINE FOR SAND MOLDING.

ramming the sand in the flask about the pattern by hand; but machines have been invented designed to perform the work mechanically by compressing the sand about the pattern by the forward movement of the pattern and follower, forming a plunger. In these machines the pattern and follower formed the movable bottom of a box, into which the sand was first placed, and over which a half-flask was then placed, and the plunger forced up, carrying with it the sand which was compressed in the half-flask about the pattern; then the follower and pattern were withdrawn, sometimes at the same time, and sometimes the pattern first and then the follower. None of these machines have, so far as we are advised. proved sufficiently practical to have been brought into general use. This invention claims to have overcome the defects inherent in former machines.

The cut shows a vertical section of said machine, which is adapted for working this



STEAM EJECTOR.

process, in which the open flask into which the sand is introduced is shown in position on the box which contains the pattern head and follower, the mechanism for simultaneously advancing and successively withdrawing the pattern and follower heads. The machine for working the process does not form part of this application, and will be covered in a separate patent of even date herewith.

This improved mode of mechanical molding may be carried on with the sections of any ordinary two-part flask. and can be worked in the following manner: The half-pattern is attached to one of the sections of a sectional follower working in a box of which the plunger forms a movable bottom. The half-flask is then fitted on to upper edge of the box, and box and flask loosely filled with sand. A cap is then placed on top of the flask and fastened, and the plunger raised, compressing the sand about the pattern. In this mode of molding the flask is filled with sand before compression, and the box only need contain enough to supply the quantity needed for the shrinkage in bulk on compression. Of course the quantity of sand and movement of the plunger must be such that the face of the latter will, when the work of compression is done, be flush with the edge of the flask to form a correct casting.

It is in this preliminary filling of the flask with loose sand that this invention is distinguished from allbefore known, as thereby the ordinary half flask with bars to support the sand can be used.

It will, however, be understood that it is not necessary that the flask should be absolutely filled with sand. The term is intended to include the approximate filling of the half-box.

When the pattern has thus been embedded in the compressed sand, it is withdrawn while the other sections of the follower support the adjacent sand; then such remaining sections are withdrawn, the half-flask removed, and another substituted to form the complete mold.

CLAIM.—As an improvement in the art of molding in sand, forming molds by compression by first filling loosely the open flask placed over a box and movable follower, then closing the flask, and afterward compressing all the sand into the flask about the pattern by the uniform forward movement of the follower and pattern, then withdrawing the pattern, and finally withdrawing the intermediate sections of the follower. substantially as set forth.

IMPROVEMENT IN HAND-DRILLS.

Specification forming part of Letters Patent No. 195,692, issued to WALES ALDRICH, of Dayton, Ohio, assignor of half his right to the Dayton Machine Company.

This invention has for its object certain improvements in vertical hand-drills for blacksmiths and other artisans, whereby great strength and efficiency are obtained, combined with simplicity of construction.

The improvements consist in the combination and arrangement of devices for regulating the feed, and in other details, as will be set forth.

In the accompanying drawings, Fig. 1 represents a front elevation, Fig. 2 a plan view, and Fig. 3 a side elevation, of an improved drill.

A represents the frame-work of the machine, of the shape shown, and provided at its upper part with two vertical and three horizontal journal-brackets, lettered, respectively, *a*, *b*, *c*, *d*, and *e*.

The driving-wheel B, with straight and beveled gears, as shown, is keyed upon a shaft, *f*, that is journaled in the brackets *a* and *c*, and has upon its outer end the actuating-crank *g*. Tbrough the brackets *d* and *e* is journaled a shaft, *h*, on the outer end of which is keyed the fly-wheel C. Half-way between the brackets on this shaft is a worm, *i*, and meshing with the straight gear of the wheel B is a pinion, *j*, also keyed upon the shaft *h*. Upon a vertical stud or shaft *m*, secured in the top of the frame A, Fig. 2, is a cone-pinion, *l*, with two gears, the lower of which engages with the worm *i*, and receives motion therefrom.

D, Figs. 1 and 2, is a metal bracket, fastened upon the top of the frame, as represented, and in which is secured the vertical stub-shaft *k*, on which the pinion *n* revolves, receiving its motion from the upper gear of the cone *l*.

On the outer corner of the bracket D are bearing-ears *o*, between which is pivoted the lever *p*. By pressing this lever down the pinion *n* is raised upon the shaft *k* until it is disengaged from the cone *l*. When the lever is raised a spiral spring *q*, upon the shaft *k* forces the pinion *n* back to its engagement with the cone.

The drill-stock is composed of two parts. The upper of these is a screw-shaft, E, working in a female thread or nut in the bracket *a*. It is key-seated its entire length, and upon its top is a hand-wheel, F. The lower portion L of the stock passes through the bracket *b*, and has its upper end confined in the shaft E, but is free to revolve therein.

The portion of the stock G which projects from the screw-shaft E is key-seated its entire length.

The stock is made to revolve by a beveled pinion, *h*, feathered upon it, and gearing with the wheel B, as shown.

A vertical or feeding motion is imparted to the stock by a pinion, I, whose key works in the seat of the screw-shaft E, and which receives motion from the idle-pinion *n*.

It will be noticed that the upper end of the key-seat of the screw-shaft E terminates in an annular groove, *y*, whose function is quite important, for, when the shaft is screwed down, the key of the pinion, I, enters this groove, and any further depression of the stock is prevented.

When it is desired to feed the drill by hand it is only necessary to depress the lever *p*, and throw the pinion *n* out of en- gagement, when the stock can be raised or lowered by means of the hand-wheel F.

By this arrangement of par ts a simple automatic feed is secured, with great steadiness of motion, and the operator can instantly and without difficulty change the machine to a hand-feed.

The herein-described vertical drill, consisting of the frame A, with its brackets *a*, *b*, *c*, *d*, *e*, and D, parallel shafts *f* and *h*, pinions *i*, *j*, *l*, *n*, H, and I, stock G E, fly-wheel C, driving-wheel B, crank *g*, and hand-wheel F, the respective parts being constructed and arranged substantially as and for the purpose specified.

IMPROVEMENT IN STEAM-EJECTORS.

Specification forming part of Letters Patent No. 196,053, issued to FERDINAND STEELE, of Brooklyn, N. Y.

a is the inlet water-pipe; *b*, the parallel tube through which water is drawn by the annular jet of steam issuing from the mouth *c*. The steam-chamber *d* surrounds the tube *b*, and the pipe *e* supplies steam to the same.

The stand-pipe *f* discharges the water, and near the base thereof is a chamber, *h*, opening latterly into such stand-pipe; and there is a valve at *i*, opening inwardly, so that whenever the issuing jet of steam produces a vacuum action or minus pressure in the base of the stand-pipe, the valve will rise automatically, and allow air to pass into the stand-pipe with the steam and in aid of the same.

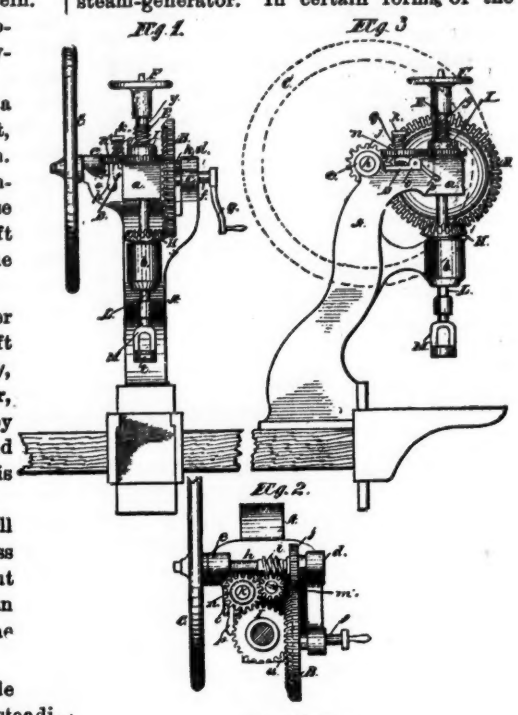
CLAIM.—The combination, with the watertube, steam-jet, and stand-pipe in an ejecting apparatus, of an inlet-valve and chamber at the base -pipe, for standof the the purposes and substantially as set forth.

IMPROVEMENT IN FUSIBLE PLUGS FOR STEAM-GENERATORS.

Specification forming part of Letters Patent No. 195,367, issued to HENRY HILLER, of Manchester, England.

This invention relates to such fusible plugs as are formed with an inner cone, which is secured within an outer cone by means of an interposing stratum of fusible metal, which has hitherto been run in a melted state into the space between the two cones. When the said fusible metal has been melted; and the inner cone has thereby been released, it has been necessary to renew both cones, or to remove both cones for repairs.

The principal object of the invention is to remedy this defect, and to enable the said inner cone, in some cases, to be fixed within the outer cone, while the latter is in position, without entering the steam and water space of the boiler; and this I accomplished by so forming the parts that the inner cone, with a coating or envelop of fusible metal, can be secured within the outer cone without removing the latter from its place within the steam-generator. In certain forms of the

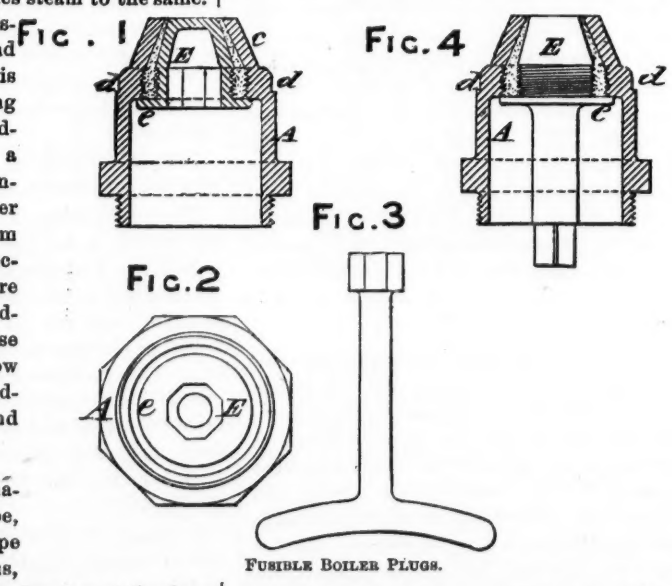


HAND DRILLS

apparatus it is necessary to enter the steam-generator to replace the part containing the fusible metal: but it is not necessary to remove the part attached to the generator. To prevent a portion of the fusible metal from being melted out in advance of the main body, a flange is formed on the lower end of the inner cone.

Fig. 1 represents a vertical section of one form of fusible plug as constructed in accordance with the invention. Fig. 2 is a plan of the plug reversed to show the interior. Fig. 3 is a representation of a key which may be employed to remove and replace the inner cone, and Fig. 4 a modification of the device for screwing the inner cone into position.

In Figs. 1 and 2, A is the outer cone, which is suitably formed to screw into a furnace-crown, or the part of a boiler, still,



FUSIBLE BOILER PLUGS.

water-heater, or similar apparatus, to which the fusible plug is to be affixed.

The upper part, *c*, of the outer cone is bored or formed to a conical shape, and at the base of this cone is formed a cylindrical part, *d*, which is chased, or tapped, or formed with a screw-thread on the inside. The inner cone, E, is made partly conical and partly cylindrical in form. The conical part is turned to a conical form, or is left rough, or is cast or formed with recesses or with flat sides. I prefer to form a screw-thread on the cylindrical part of the inner cone, and, when so formed, the conical part may be turned, and need not be formed with recesses or other means for holding the fusible metal. The base of the inner cone is formed with a flange, *e*, which is a little larger in diameter than the bore of the cylindrical part *d*.

The envelop of fusible metal is represented by the dotted space between the parts A and E. This envelop is cast upon the inner cone E, and is subsequently turned and screwed or chased to fit and screw into the outer cone, A; or it may be found to be convenient to cast the envelop of fusible metal upon the said inner cone in a mold which would be constructed to impart the required form to the outside of the said envelop, and to form the screw-thread upon the cylindrical part thereof, thus dispensing with the necessity for turning the fusible metal to fit the inside of the outer cone. The envelop may be cast separate from the inner cone, and be subsequently screwed upon the inner cone, in which case the inner cone would be formed with a screw-thread, as in the drawing. It is necessary that the outer surface of the envelop shall fit the interior of the cone *c* with sufficient exactness to prevent the escape of water when the inner cone is screwed into its place within the outer cone. When so screwed into position the flange *e* covers the base of the envelop of fusible metal, and prevents the direct action of the fire upon such metal.

In the case of plugs as previously constructed, the fusible metal sometimes melts partially, so as to permit a slight escape of steam, which checks the complete fusion of the metal, and, the inner cone not being blown out, a sufficient outlet for the steam is not formed. The flange *e* is intended to prevent any portion of the fusible metal from running out until the whole of it is fused sufficiently to permit the inner cone to be blown out, the indicated defect in the ordinary plugs being thus remedied.

The arrangements for screwing the inner cone E, into position may be varied. For example, the said inner cone may be formed with an internal cavity, a part of which cavity is of an octagonal form, as seen in Fig. 2. A key (represented by Fig. 3) is formed to fit into the octagonal part of the said cavity.

Fig. 4 illustrates a modification in the arrangements for screwing the inner cone into position. The inner cone is formed with a shank projecting into or toward the fire-box or furnace. The lower end of this shank is squared or otherwise shaped to be turned with a screw, key, or spanner.

CLAIM.—1. The outer cone of a fusible plug, provided with screw-threads on the inside, in combination with the inner cone and its fusible-metal envelop, adapted to be screwed into the outer cone, substantially as described.

2. The combination of the threaded outer and inner cones with the envelop of fusible metal, adapted to be screwed into the outer cone and on to the inner one.

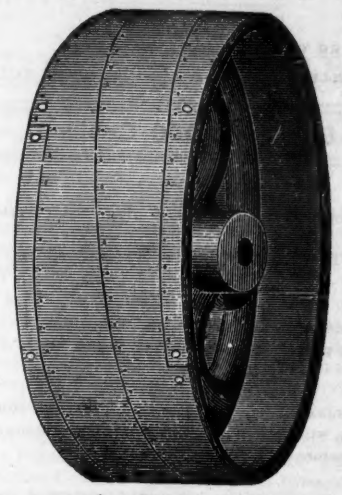
3. The combination of the cone E, provided with the rectangular collar *e*, with the outer cone and the intermediate fusible metal, as and for the purpose set forth.

Slipping of Belts.

In a lecture by John W. Sutton, M. E., (95 Liberty street,) on transmission of power by belts, before the Academy of the Useful Arts, on Tuesday evening, 13th inst., he said: "Perhaps the worst engineering work done, is to drive a machine by two separate belts upon two pairs of pulleys; if the pulleys are exactly the same size, which is not often the case. (The lecturer gave an instance that had come within his own knowledge, in which one of the driving pulleys was 3-32 of an inch the largest in circumference, the pulleys revolving 320 revolutions per minute, and running night and day, one belt was obliged to slip 3,600 feet every day, of 24 hours, from this cause alone.) How much in horse-power this amounts to is hard to say, but the wear of the belts is very considerable. But if the pulleys are exactly the same size, and they can be made so, the belts cannot be made of exactly the same elasticity lengthwise. No leather belt is of the same elasticity in its parts, as at the joints it is thickest and less elastic than between the joints. To make this clear, let us take an exagerated case. If we have two pulleys, each of two feet diameter, the driver revolving 100 revolutions per minute, it is possible to make the other pulley revolve but 50 revolutions in the same time, and the belt not slip by using an elastic belt a belt of pure rubber without cloth. In this case the belt shall be of such an elasticity, that after it is put on the pulleys, 40 pounds more tension shall stretch the belt to twice its present length. Now if the 40 pounds of work is put upon the driven pulley and the driver is started, the driven pulley will not move until one-half of the work side of the belt has passed to the driver, and then each inch of the stretched part of the belt, as it leaves the driven pulley, will contract to one-half an inch, and as the belt on the slack side goes upon the driven pulley, in its contracted state, will, as the pulley revolves and is put under the 40 pounds strain, elongate from one-half an inch to the full inch, and we will have the driver making 100, and the driven 50 revolutions, and the belt not slip. Now every belt has some elasticity, and all have more than is generally supposed. Think how much the belt is stretched to make the ends meet when you lace it anew, and look at a belt running without a load, and then with all the load the belt can carry, and see the difference in the slack side, and you will see the elasticity of the belt very plainly. As all the difference in the slack side is the stretch of the work side of the belt. Now with the two belts and their pulleys; if one belt has an elasticity of 1-18 of an inch to each foot of its length, and the others 1-32 of an inch to each foot of its length, then there will have to be a continual slip, one way or the other, of 1-32 of an inch for every foot the belt travels. Suppose that one-half of one belt stretches 1-32 of an inch more than the other, and the other half stretches just the same; here we have the slip intermittent; no doubt this is the fact in every case of the kind, that the belts run together a part of their revolutions, and are opposed the rest of the time. Or, as is always the case, they are not put on with the same tension, it is more aggravated. It may be laid down as positive, no two belts can be put on so that they will run together without loss of power. In the books it is often found that leather belts will do more work if put on with the grain side next the pulley. A belt holds on a pulley by friction between the belt and pulley, and by nothing else. The amount of the friction depends upon pressure (tension of the belt) and the elasticity of the surface of one or both. I now am speaking of another kind of elasticity, surface elasticity. I have here a six inch diameter pulley, and will slip it upon this small shaft; it goes on freely and revolves easily, as you see. Here I have a piece of one inch leather belting, the usual belting sold by dealers, on one end of it is a 4 pound weight, and on the other end is a loop to put my foot in—between the loop and where the belt goes over the pulley, I have put a spring balance, so that the exact amount of position can be seen in pounds. Putting my foot in the loop and hanging the belt over the pulley, we have now the belt on the pulley with a tension of four pounds, the belt embracing one-half the circumference of the pulley. The end having the weight is the slack, and the loop end the work side of the belt. The spring balance stands at four pounds of course, the number of pounds in the weight on the end of the belt. I now revolve the pulley from the loop end with my fingers against the arm, and slip the belt, the spring balance shows eight pounds, taking the four pounds that was the pull of the weight, and we have four pounds as the friction of the belt on the pulley; this, as you will see, was with the hair or grain side to the pulley. Now we will turn the belt over and see the effect. I turn the pulley again and the spring balance shows nearly nine pounds, just how much, it is not delicate enough to show, but there is at least 15 per cent gain, if not more. If you will examine this belt, you will find the flesh side is softer, and more elastic, than the grain side. Let us carry this experiment a little further. I have here a pulley covered with a patent pulley cover, which, as you see, is made of rubber and canvas, not at all like a rubber belt, as that is made as firm as possible, but this is made of elastic rubber, so as to have as much surface elasticity as possible. I now put the same belt over the same sized pulley with the same amount of wrap (one-half the circumference), and turn the pulley in the same way, and the spring balance shows 20 pounds, which leaves 16 pounds, as the friction between the rubber covered pulley and belt, as against four pounds with the grain side upon the iron surface of the pulley. This difference is entirely due to the elasticity of the surface in contact. In putting on this cover, I warrant it to do double the work before the belt will slip; and in practice, I have found it will do so in every case. Wrap of the belt has much more to do with friction than is generally known. We will take the same belt and the plain pulley, and arrange the belt so that it embraces but 90° or one-fourth the circumference of the pulley, the weight hanging in the same place, I revolve the pulley and the spring balance shows five pounds, that is one pound of friction for four pounds of tension, with 90° of wrap. Now we will lower the loop end of the belt until it embraces 135,° and revolve the pulley, the spring balance marks six pounds. We now have two pounds of friction or double, while we have increased the belt surface but 45° of wrap, or one-half; we now put the loop end so that it embraces 180° or one-half the circumference, adding 45° more wrap, and turn the pulley, and the spring balance shows eight pounds, or four pounds as the friction; by adding one-third more wrap we have doubled the friction or working capacity of the belt and pulley. There is found in some of the books on belting, that if a belt is run over a large and a small pulley, the belt will slip on the large as much as on the small one. A belt holds on a pulley as the square of the degrees of wrap, and as a straight belt from a large to a small pulley must embrace more than 180° of the large pulley and less than 180° of the small one, the belt will slip on on the small one, just as we have seen in our experiment with the wrap. There is one exception, a cross belt will embrace the same number of degrees on each pulley, whatever the sizes. I saw a case where the belt sliped on the larger pulley, but it was the lower pulley, and the upper pulley had the difference of tension or pressure of the weight of the belt. In this case the upper pulley was two feet, and the lower four feet, crossed belt; distance between shafts, about 12 feet." The question was asked the lecturer, how fast can a belt be run. "A belt can generally be run as fast as a pulley can run without bursting by centrifugal force. So it is a question of material of the pulley. High speed pulleys, of large size, should be made with the rim of pine, as it is about three times as strong in proportion to its weight, as cast-iron. The English engineers make a pulley of wrought-iron. That is the lightest and strongest pulley made, and for high speeds, it must eventually come into use. The cast-iron of this country is so much stronger than the English, that our cast-iron pulleys will run safely at much higher speeds. English engineers are putting in hemp rope bands instead of leather belts, and in one case are using 15 five inch ropes as a main driving belt; of course they are run in grooves. Their weight must be four or five times as great as a belt. If two belts driving the same shaft are a nuisance, owing to their longitudinal elasticity not being alike, what must 15 ropes each one of a different tension and of course of different elasticity be?" In answer to a question by one of the audience, "how long would the cover last?" the lecturer said, "there are covers of this material that have been in constant use in this city since June 1873." The lecturer then gave an explanation of a plan to find the horse power that a belt transmits, without the use of Dynamometer; that we cannot describe without drawings.

Pulley Cover.

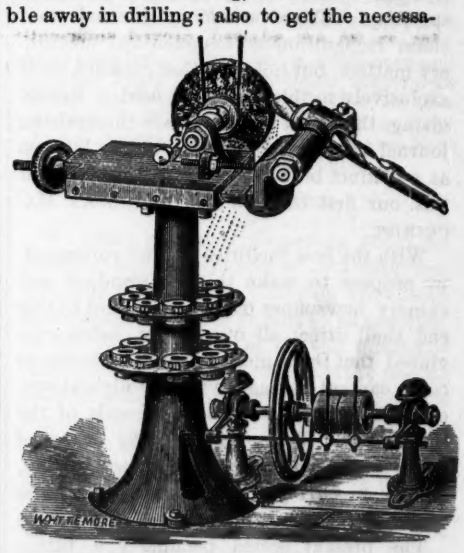
The cut below represents a pulley covered with the patent pulley cover mentioned in the experiments made by Mr. John W. Sutton before the Academy of Useful Arts on the 13th inst. The cover is made with alternate layers of the best elastic rubber and canvas—four layers of rubber and three of canvas. The canvas is cut straight, so as to give the greatest strength with the least material. The cover is made from two to six inches wide; on one edge is a lip of one ply of canvas one-half an inch wide, and on the other a rebate that the lip will fill when the cover is wound spirally around the face of the pulley. This lip and rebate is to join the cover together across the face of the pulley by cementing and driving small copper nails through them both, that clinch when the point strikes the face of the pulley, so that the cover when on is as a whole one. One end of the cover is riveted to the pulley and wound on firmly, fastening the edge by copper rivets, and the other end is finished by riveting in the same way. It is put on the pulley without taking it down or disturbing the shafting in any way.



The cover is claimed to transmit one hundred per cent more power than a plain pulley, that is, it will do twice as much work before the belt will slip. It is manufactured by John W. Sutton, 95 Liberty street, New York.

Twist Drill Grinding Machine.

The time consumed and trouble entailed in grinding twist drills, so they will work correctly, has caused much annoyance in large machine shops. Machines have been devised to grind them true, but being complicated and expensive, they have come into but limited use. The illustration of a twist drill grinder, by Wm. H. Eddy, Worcester, Mass., which we present herewith, gives an idea of a simpler and less expensive machine for this purpose than any other that has come under our notice. It is designed to enable the operator to make the cutting edge or lip of the drill thick and strong, so it will not crumble away in drilling; also to get the necessary clearance to have the lip true with the twist or outside surface, and do it quick.



It is constructed to grind crooked drills as well as straight ones, by griping them in the collar by the end or point. It takes but little room and but little power to run it. A collar is furnished to hold each sized drill, from ¼ to 1½ inches diameter, but we understand Mr. Eddy is making an improvement, by means of which the collars may be dispensed with, and a single adjustable chuck used to hold all sizes of drills. Extra collars are furnished for grinding flat drills from ¼ to 3 inches in diameter, and twist drills to 2 inches in diameter.

TRIAL OF STEEL WIRE ROPE hawser have been made recently at Portsmouth Dockyard, with the result of showing that the breaking strain of the steel wire ropes is more than three times that of a hempen hawser. The sizes tested were respectively 7 in., 6 in., and 5½ in. in circumference, and were guaranteed to have a breaking strain of 110 tons, 80 tons, and 67 tons, respectively. They broke at 118 tons, 92 tons, and 75 tons, in each case considerably higher than the guaranteed strain, although the ropes actually tested were picked out at random. The core of each rope is formed of tarred hemp, over which are twisted the strands of wire.—*Eng. Mech.*

AMERICAN MACHINIST

PUBLISHED MONTHLY

BY

MILLER & BAILEY,

Editors and Proprietors.

88 Warren Street, New York.

H. B. MILLER. JACKSON BAILEY.

Edition, 5,000 Copies.

SUBSCRIPTION

$1.50 per year, in advance, United States Postage prepaid.

To Foreign Countries, $1.50, postage added.

ADVERTISING.

Outside page, 35c. per line, each insertion.

Inside pages, 20c. per line (12 lines one inch).

BRITISH AGENCY.

HAMMOND & Co., 5 Grocers Hall Court, Poultry, London, will receive and forward subscriptions and advertisements on our regular terms.

EDITORIAL ANNOUNCEMENT.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

NEW YORK, NOVEMBER, 1877.

Introductory.

In this practical age progress is so rapid, that, to give currency to new ideas and improvements as they obtain, nearly every large class of business has its representative newspaper, or in some instances, two or three acknowledged representatives, each treating wholly on topics pertaining to its specialty. There are many journals that claim recognition as exponents of machinery matters, but not one that confines itself exclusively to this important field. Recognizing the want of a live, enterprising journal to represent the machinery interest as a distinct branch of industry, we present this, our first issue of the AMERICAN MACHINIST.

With the best facilities at our command, we propose to make this the standard machinery newspaper of America, and to this end shall direct all our efforts, being convinced that the same editorial and business corps can not manage with the highest success two or more technical journals of the same class. *We are not specially interested in the sale of machinery or other merchandise, nor the procuring of patent rights, nor have we any pet scheme to advance or hobby to ride.*

The present seems peculiarly a fitting period to start out upon the territory of enterprise we have chosen, for indications are strong and positive that the fog which has for four long years enveloped the commercial progress of our country is about to lift—slowly it may be, but surely. Already light begins to dawn, and the full sunshine of business prosperity will show a development of American machinery such as the world has never before witnessed. The genius that has distanced the old world in useful mechanical inventions will brighten still more under influence of auspicious times, and rapid improvements will be wrought, the adoption of which will leave far behind those who cling to old ways and processes.

To keep our readers informed as to the most important and valuable of these inventions within the scope of machinery, giving suitable illustrations of new objects and discursive reviews of the same, is one of the prime objects of the AMERICAN MACHINIST. At the same time we shall always act independently, not holding ourselves under the least obligation to give "favorable notices" of anything under review, but rather to elicit the plain truth whether it be favorable or unfavorable. Every review of a mechanical object that appears in our columns will be prepared by a thoroughly competent party after a satisfactory examination. In our department of manufacturing information, all "news" we do not know to be reliable, will be excluded, as well as all matter that has become stale by going the rounds of the press.

We also propose to lay before our readers regular information concerning exports of machinery and mechanics' supplies, digests of the principal new patents relating to our specialty, correct market reviews and price lists, live editorials and varied technical correspondence.

To our many friends and patrons who have so fully and so gratifyingly sustained and encouraged us in this undertaking, we return our sincere thanks with the assurance that their confidence is not misplaced. Having no old or damaged journalistic material to dispose of, but with an entirely new sheet, original in its conception and presenting a high style of typographical art, we step upon the stage, make our bow and wish a long and pleasant acquaintance with a large audience of readers.

Good vs. Medium Machinery.

The favor with which American machinery and tools has been received in foreign countries wherever introduced should be a source of pride to every intelligent mechanic in our country. Why have they been so well received? Clearly, because American machines and small tools are better made, more finely finished, and better adapted to the purposes for which they are designed than those of the same class made in Europe. So long as our manufacturers keep up and improve the standard of their productions we can expect to have an increasing foreign demand until "the workshop of the world" shall be on this side of the Atlantic instead of in England. But we regret to refer to the fact that many establishments previously sustaining a fair reputation for mechanical productions have, within a year or two, lowered their standard, still offering their wares on the market with the same endorsement as before. Since the depression in business caused the selling of machinery on very close margins of profit, some houses, in order to cheapen original cost, make up for bad debts, undersell their competitors, and maintain former profits, began to use inferior material, and to employ unskilled workmen, the inevitable result of which has been to impair their reputation for good work, which no house continuing in business can afford to sustain. In some instances this course may have been adopted from lack of capital or other means to fully compete with more favored parties, but the deterioration has by no means been confined to the smaller establishments; on the contrary, the latter have averaged well with the stronger houses in keeping up and improving the quality of their goods. This tendency to depreciate the quality of a machine or small tool in order to make it cheap cannot too forcibly be condemned, though it cannot be denied that consumers are too often inclined to let the single element of price have more weight with them in making a purchase than quality, fitness and durability. Observation should teach every machinist that it is cheaper in the long run to obtain good reliable working tools from houses making such work only, and having the well known reputation for doing so, than to order low priced work of questionable quality.

Happily there are establishments whose reputation for building first class machinery stands virtually unimpeached, and we hope and expect to see the number increased.

In buying tools from such houses the purchaser can feel the assurance that his money is not wasted though they cost more than those that would only "answer the purpose." Should he wish to sell at second hand, the difference in value would soon be apparant. The old adage, "A workman is known by his tools," might well be framed and hung up in the office as well as in the shop. Poor tools are apt to make poor workmen, keep them in order the best you may. It is no valid excuse for fitting up a ship with shoddy machinery to say that "business is dull," for the shops that run on that kind of work are likely to experience increasing dullness as general business grows brighter. Every machine or tool maker should have ambition in elevating the standard of his productions.

Keep Up to the Times.

The most rapid progress has been made within two or three years in perfecting small tools and supplies for the machine shop. Inventions of accurate and automatic machinery, for making such articles, have not only cheapened their cost, but have raised the grade of requirements, until the persistent use of some tools that were accepted three years ago as the best that could be procured, places a shop at a great disadvantage by the side of wide awake establisments, that are up to the times. The extra cost of buying the best and most improved tools and supplies, to replace those lacking in adaptation, efficiency, or accurate working qualities, is more than compensated for, by securing better facilities for business. Perhaps some will say, "O! we can't afford to buy new tools when we can't get work to keep the old ones employed." Our answer is: "There is a certain amount of work to be done whether business is slack or lively, and those shops that have well known facilities for doing the best and cheapest work, will get the orders. If you are behind your neighbors in this respect, catch up if you can, if you can't, come as near to it as possible, even should it involve an extra outlay or working tools."

Taps, dies, screw-plates, machine screws, calipers, reamers, drill-chucks, and lathe attachments, have been wonderfully improved within the time above mentioned, so have many other small articles for the machine shop, not now present to mind, A few months ago we called on a venerable machinist in a Pennsylvania town, and was much amused to see him working on an old fashioned lathe with "hook tools" (one end of the tool hooked over the shoulder,) which some of our present day apprentices may have heard their grandfathers describe. His shop, one of respectable size too, was no place to sell newfangled notions. Various degrees of backwardness may be found in modern machine-shops, as well as in those of older date, but the above case we commend to some of our enterprising commercial travelers.

First Principles.

It is a mistake to assume that a mechanic knows all that it is necessary for him to attain, when he becomes skilled in the special kind of work he may have selected. There is a great deal of ignorance of first principles among careful and intelligent workmen, where it ought not to exist. A man may have a thorough knowledge of running an iron planer, yet never become informed as to the designs and details of constructing a planer and the advantages or disadvantages of particular features. The underlying principles of any business or occupation ought to be made a regular study by those engaged in it, so that the road may be open to them for progress and improvement. We often find mechanics that have dropped down into a dead-set way of doing a thing, and are positive in discrediting the value of any information that conflicts with their own fixed methods and ideas. In almost every instance of the kind, this disinclination to give up old settled ideas for those more valuable, may be traced to lack of elementary knowledge. Some men apparently blunder into a fair mechanical success, in certain directions, without any regular preparation or fitness, and are always afraid to reach out for something better, lest they lose the hold they have already secured. While all can not be inventors or designers, it should be the aim of every mechanic to know the why and wherefore of his especial work, so that he may be rooted and grounded in the kind of knowledge he is required to possess.

A mechanical engineer of large acquaintance in Paris, speaking fluently French, German and English, is now arranging to represent several exhibitors of American machinery at the Exhibition of 1878. This gentleman has high references both in this country and Europe, and we will place in communication with him any manufacturer who wishes to be so represented, and to open a trade for his machinery in France. He will sail early in January, and will represent and correspond for the AMERICAN MACHINIST previous to, and during the exhibition.

Tuition in Mechanics.

ACCORDING to a table recently compiled showing the occupation of the parents of pupils who have attended the Pittsburgh high school during the past ten years, it appears that a majority of the students belonged to the artizan class. A recapitulation of the table shows that during the period named 696 children of skilled laborers have been in attendance: of unskilled laborers 232; of merchants and storekeepers, 258; of professional men, 154; of widows, 128; of office-holders, 36: miscellaneous, 209.

Probably the school records of all our large manufacturing cities and most of the smaller, would show on examination a preponderance of pupils whose parents belong to the mechanical class. Considering that the boys are likely to follow, when they become old enough to select an occupation, very much the same line of business that their fathers have done, it is pertinent to inquire whether they receive at school any instructions in the elements of mechanical knowledge.

A little tuition in the first principles of mechanism, illustrated by simple experiments and accompanied by conversational lectures on the part of the teacher, is what should be insisted upon in every high school or grammar school in our country. The "course" in Natural Philosophy dwelt upon in the curriculum of most public schools of the higher grade, is too often nothing more than a dull routine of text book study, which instills in the pupils' minds scarcely anything of permanent value, but rather begets a distaste for mechanical research.

Without the aid of books an interest should be created by the competent teacher in the elementary principles of mechanics and a spirit of inquiry developed in the mind of the young learner. All of us know how lasting are youthful impressions, and how easy it is to acquire in a short space of time at an early age tastes and inclinations that shape the future course of a busy life. Do parents sufficiently examine into the way their children are "educated" in the public schools? This is obligatory on their part. Skilled workmen, and to such we address ourselves, should insist upon having teachers employed who possess the ability to impart elementary mechanical knowledge in a way to interest their children, and should further insist that some time be given to this important branch out of every school day. It would be no hindrance to other branches, but would rather be a help, for children's progress is generally measured by their interest in school. Let a good, correct foundation of elementary mechanical knowledge be laid and the boy will go forward. United action on the part of practical artizans, who depend on the public schools to educate their children, will in almost any city, secure the kind of instruction we refer to. A little agitation of the subject will awaken a pride in the teachers themselves, and the ball can soon be set rolling. How many children, when they leave the public schools, can intelligently describe the steam engine or explain the simple mechanical powers? In this practical age, let the youth be taught practical ideas.

We send out every copy of this, our first issue, gratuitously, and open our books to enter subscribers. We should be pleased to hear from all those interested in machinery or machinists' supplies, into whose hands a copy may fall, how they like the iniatiatory number of the AMERICAN MACHINIST, and to receive suggestions on special topics to be hereafter treated upon.

A press dispatch from Montreal says: "The steamer Newfield has nearly completed her cargo for the Paris Exhibition. She will have to make a second trip to take all the Canadiau exhibits."

As we go to press news reaches us from Washington of the passage through the House of the Paris Exposition bill, appropiating $150,000 to pay the expense of exhibits from the United States, *by a majority of fifteen.*

Some interesting and valuable tests of lubricating oils are now going forward, under direction of a well known competent scientific authority, the results of which we expect to lay before our readers in a subsequent issue.

The U. S. Patent Office did the largest business in October this year of any month since its organization. This indicates not only unusual activity of inventive genius but the return to more prosperous times.

MANUFACTURES

CONNECTICUT.

The Victor Sewing Machine Co., Middletown, have sold within a few months over eight hundred of their "Victor Chucks."

John Adt, New Haven, manufactures a machine of his own invention that will make 3000 to 4000 feet of pump-chain per day from the rod, It is automatic' and two or three of them can be run by one man.

The Hartford Foundry and Machine Co. have just completed a 50 horse power engine (20 inch by 48 inch) for the Carson & Brown Co., Dalton, Mass. This is to furnish power for one of the oldest paper mills in the United States, having been established in 1801.

Reynolds & Co., New Haven, is one of the oldest houses in the manufacture of machine screws, having been established in 1866 They make cap, set and machine screws and machine bolts in large variety, from 1200 to an ounce to bolts 4 inches in diameter. They also make the Eames Patent Molding Machine for foundry use.

The Pratt & Whitney Co., Hartford, are running their tap-making department ten hours a day. They have unique automatic machinery for threading taps, the invention of Mr. J J. Grant, who has charge of this department. He has given the subject close study for several years and is well satisfied—in fact enthusiastic—with the results obtained.

On a recent visit to Essex we were shown through the Emery wheel factory of Goddard, Son & Co., and observed many things of interest in this special business They have a large variety of shapes, sizes and grades of wheels suited to different kinds of work. A new hydraulic press of 1000 tons capacity; built by John Robertson & Co., Brooklyn, was put in a few weeks ago, which does some wonderfully close squeezing.

We lately witnessed the operation of some ingenious automatic machines for tap making in the works of H. Prentiss & Co., Essex. The machine for threading has a revolving head, containing from 15 to 40 cutters, each of which cuts in its turn a light shaving until the last clears out the channel, having scarcely any cutting to do. While the thread is cutting the tap is being "relieved" by a peculiar cam motion of the cutters. After the thread is cut the tap is placed in another machine and grooved out. It is evident that taps can be cut on these machines of any angle or pitch of thread by simply grinding the cutters to the desired form. Again, the cutters being comparatively seldom called into action, are likely to retain their exact form and sharpness for a long time. The rapidity with which taps are made on these machines is something remarkable. They are the invention of the Superintendent, Mr. Alfred Goddard, and we are informed that the first threading machine built, worked perfectly without the least alteration after it was completed.

A few weeks ago we had the pleasure of witnessing the operation of very ingenious automatic screw making machine, in the works of the Hartford Machine Screw Co. This company, we understand, has expended over $60,000 within the past few months, in setting up machinery and preparing for work. In a shop, 200 feet long by 35 feet wide, they have over 50 machines at work, but the number of workman is small. It is claimed that one boy can attend 10 to 12 machines. We noticed one machine making 2000 small milled machine screws a day, another making 1000 piano agraffs a day, milled and finished from a coil of brass wire, another making 3,600 machine screws a day from four bars feeding at the same time. Their line of productions seems to embrace all kinds of screws, and other small articles turned from brass, iron, and steel wire and rods. Mr. Geo. A. Fairfield (inventor of the Weed Sewing Machines and superintendent of their factory) is president, and Mr. Daniel Morrell, secretary and treasurer. The inventor of the automatic machinery is Mr. C. M. Spencer, who is still applying his talents in the same direction.

ILLINOIS.

The Chicago Axle and Forge Company have applied for license of incorporation, with a capital stock of $60,000. The incorporators are Henry Childs, H. A. Gardner and A. T Ewing, and the object of the company is the manufacture and sale of all kinds of forged ironwork.

MASSACHUSETTS.

A new machine shop is building in Worcester, near the junction, to be let out with power.

The American Steam Guage Co., Boston, have sold over 100,000 steam guages in this and foreign countries.

David W. Pond, Worcester, has nearly 100 men employed, on full time, making machinists' tools. When pushed to full capacity his shop will accommodate 200 workmen.

Jerome Wheelock, Worcester, is building a 300 horse power (28 inch cylinder, 48 inch stroke) variable cut off engine, for Sargent & Co., New Haven; also a 40 horse-power engine for parties in Connecticut.

The business of the Worcester Machine Screw Co. was started in 1867. They have lately built a new shop and enlarged their capacity. They make set, cap and machine screws in great variety with improved machinery.

H. F. Fearing & Co., Boston, made the largest chain ever forged in this country for the Washington Navy Yard. The links were of 2¾ inch iron. They test all their chains on a machine with weights and levers which is more reliable than a hydraulic test.

The Whitin Machine Co., Whitinsville, Mass., are running with nearly their full force of 700 men. Considerable new machinery has been added to their extensive shops, and lately the working force has been steadily increased. They build cotton and woolen machinery in great variety.

The Fitchburg Machine Works have nearly completed a large order for machinery to fit up the Scott Foundry, of Reading, Pa., which they have been at work on for the past three months or more. They have recently built a number of machinist's tools for the Brunswick & Albany Railroad (Georgia).

Stone & Hazelton, Boston, are manufacturing a new style of engine lathe. It has a hollow spindle, with hardened bearings and a draw-spindle to close the chucks which are made of hardened steel. The chucks are made to hold stub's wire or wrought brass from 1-16 to 1-4 inch. It has cast iron bearings with steel spindles. All the parts are heavy in proportion to its size and the lathe is intended to stand a great deal of hard usage.

The American Tool and Machine Co., Boston, build most of the turret lathes for brass-work used in this country, also have sold them largely to England, France, Germany and Austria. They fit up brass shops with all the machinery required one hundred men are now employed besides thirty at their Hyde Park foundry.

McCloud & Crane, Worcester, have designed and constructed a peculiar automatic machine for making milled machine screws with four bars feeding at once. While one screw is milling another is threading, another squaring up under the head and another pointing. One man can do as much work with this machine as two men with two machines of the ordinary kind.

James L. Hall's Old Colony Rivet Works are running briskly, making a speciality of two new tools—the "Old Colony hand-punch" and "Old Colony trimmers' snips." The latter is claimed to be a great improvement over the snips commonly used by workers in tin and metals. In cutting plate, both handles are above the work, the metal passing through a slot at the side, so that the hand is not exposed to the sharp edges of the metal operated upon, and the parts are not warped in being cut.

The Taunton (Mass.) *Gazette* gives the following cheerful account of business matters in that city: "As an encouraging sign of the revival of business, the cotton manufactories in the city are all running with full complements of hands and on full time. Reed & Barton's Britannia Works have over 500 hands at work; Mason's Machine Works have about 500 on the pay-roll, and are still increasing their force; nearly all the stove manufacturies and iron works are filled with orders as they have not been for two years before; the copper works are doing their usual business. Nearly every branch of manufacturing and mechanical business generally, wears an encouraging aspect."

MISSOURI.

The St. Louis *Globe-Democrat* of October 8, says: Yesterday afternoon the firm of Shickle, Harrison & Co. shipped to New Orleans, *via* the Iron Mountain Railroad, the bed of a cotton press weighing 44,660 pounds. The casting was hauled from the corner of Fourteenth and Poplar streets by a team of 14 horses as far as Fifth and Poplar, where they stalled, the broad wheels of the wagon sinking into the ground several inches. They had to procure the assistance of a ocomotive to help them out.

NEW JERSEY.

Oscar Barnett, Newark, is running his malleable and grey iron foundries to their full capacity with orders never better.

Heller & Bros. file works, Newark, are running full time with their full force of 65 men. Trade is better than last year at this time.

Davis & Gould, Newark, have just brought out a new style of friction hoisting engine and are getting up some drain pipe machinery.

J. S. Mundy, Newark, has lately built a 40 horse-power cut-off engine, for a grist mill in Maryland; a double-pile drawing engine for Norfolk, Va.; and another for Pensacola, Fla.

The Trenton (N. J.), Iron Company recently rolled in one of its rod trains 39,875 pounds of "No. 4" wire rods in nine hours. This is claimed to be the "fastest time" ever made on wire-rod rolling.

The Newark Steel Works, Benjamin Atha & Co., are building a new rolling mill 106 by 196 feet, which is to contain three trains of rolls, one 16 inch, one 8 inch and one 9 inch respectively. The mill will be completed about January 1. They are now making about 200 tons of steel per month, but the completion of the new mill will increase the capacity to 300 tons a month.

Edward N. Wrigley has just completed a four story brick machine shop, 17 and 19 Railroad avenue, Newark. It is 150½ feet front and 80 feet deep, with an L, 80 by 34 feet. The shop is well lighted and ventilated, and will be let out with power to suit tenants. Mr. W. began business 15 years ago as a dealer in second-hand machinery with $450 capital, his stock in trade con iting of an old iron planer, a wheelbarrow, and a few small tools.

The Passaic Machine Works, Watts, Campbell & Co., Newark, have a shop full of work. They are building a 250 horse power high pressure engine for John H. Stearns & Co., New York, and another of 400 horse power for the Newark Steel Works. The balance wheel for the former is 22 feet diameter and weighs 26 tons, that for the latter weighs 22 tons and is to run 70 turns a minute. The bed piece for the larger engine is cast in one piece and weighs 16 tons, being the largest casting ever made in the State of New Jersey.

NEW YORK.

Somers Bros., Front and Pearl streets, Brooklyn, have about sixty-five hands at work making fine sheet metal goods, presses for drawing out sheet metals, fine machinery and special tools.

John Robertson & Co., Brooklyn, have about thirty men at work full time, and find business improving. They have under way hydraulic presses for plug tobacco, baling presses for carpets and dry goods and presses for pork scrap, also some lead pipe machinery for the West.

A. & B. Wiltsie, Catskill, have a small force of men, in their machine shop, at work upon Hall's brick machines, which they have been building for 30 years. They have made over $100,000 worth of ice hoisting machinery for the Knickerbocker Ice Co., and are the inventors of the machinery in general use throughout this country for hoisting ice.

Messrs. Torrance, Merriam & Co., of Troy, N. Y., are employing between 80 and 90 workmen, and report orders coming in freely enough to keep them pretty busy. They have never lost a day during the past fifteen years, although their works have been burned out during that time. They ship their malleable castings to Europe direct, and have a large home trade.

PENNSYLVANIA

Screw-making machines are being manufactured at the Cambria Iron Works, Johnstown, and if they prove a success it is proposed to erect buildings and establish works of sufficient capacity to turn out 10,000 gross of screws a day.

The ten steel works of Pittsburgh are all in operation; Park, Bro. & Co. partly double time with 380 hands. They have just built a new warehouse and just completed a new battery of six boilers. Reese, Graff & Woods are running double time with 600 hands. They are making a new article of steel boiler plate. Brown & Co. are working single turn with 300 hands. The Crescent Steel Works are partly on double time with 250 hands. Anderson & Passavant are driven to full capacity double time. Hussey, Howe & Co. are working single time, yearly product about 13,000 tons. They are building a new office at the mill. Edgar Thompson Steel Works (Bessemer) are running double time with 625 hands. Smith, Sutton & Co. run single time with 250 hands and will soon run double time. Singer, Nimick & Co. are running single turn, having at present in their employ 350 men.

Jones & Laughlin, of Pittsburgh, are running to their full capacity, double turn, giving employment to 2,000 men. These works are supplied with 75 puddling furnaces, 30 heating furnaces, 28 trains of rolls, 73 nail and spike machines, with a capacity of 50,000 tons per annum. A new addition, 80x100 feet, has been built to their polishing shop. This firm are proprietors of patents for cold rolled shafting, piston rods, bars and plates of iron and steel, also mower and reaper finger and sickle bars. By the use of powerful and peculiarly constructed machinery they have succeeded in rolling and drawing bars, rods, plates and sheets of iron or steel, while cold, into any of the shapes ordinarily given to hot iron by rollers. The effect of the process is to compress and pack together the fibres of the metal to such an extent as greatly to increase its strength, hardness, elasticity, &c., as has been shown by the severest tests made by the most eminent engineers of Great Britain and the United States. These cold rolled polished shaftings are seventy-five per cent more effective in strength than the same size of turned iron, and are made nowhere else in the world but by this firm. The invention was secured by patent in 1859, This concern is favorably known throughout the United States, and also in other countries, and is one of the best reputed establishments in Pittsburgh.—*Pittsburgh Commercial Gazette.*

RHODE ISLAND.

The Fales & Jenks Machine Co., Pawtucket, have 200 men at work, and find busines growing better. They have lately fitted up a large cotton duck factory in Baltimore with speeders and spinning frames. They have furnished J. & P. Coates' thread works with 115,000 spindles; Conant Thread Co. 50,000 spindles and Clark Thread Co. 12,000 twister spindles.

Exports.

Porter, Bell & Co., Pittsburgh, have just shipped another light locomotive to Cuba.

Some $50,000 worth of Blake steam pumps have been sold to South America and Cuba within the past three months, mostly for sugar plantations.

A. F. Prentice, & Co., Worcester, have sold foot lathes of their manufacture to Australia, Germany, Sweden, Norway, Japan, New Zealand and Chili.

A. & B. Wiltsie, Catskill, have just received a call for one of their tan bark grinders, from a large London tannery. The best bark grinders made in England cannot accomplish near as much work in a given time as those made in the United States.

A machine was lately designed and built by the Stiles & Parker Press Co., for parties in Scotland, which punches two rows of holes (128 holes) at a time, in a plate of copper ⅛ of an inch thick We saw a plate of that thickness 15 by 38 inches, perforated with 10,880 This work was done in 1 1 10 minutes.

The Fitchburg Steam Engine Co have recently sent engines of their manufacture to England, Germany, South America, Canada, Nova Scotia, and other countries. They usually have a good trade in Holland.

The Putnam Machine Co. have lately sold to the Honolulu Iron Works, Sandwich Islands, a steam engine 20 by 60 inches, a hydraulic wheel press of 300 tons pressure, also five engine lathes. At different times within a few months past they have sold two other engines to the Sandwich Islands. Mr. Alexander Young, one of the proprietors of the Honolulu Iron Works, has recently visited this country, and placed orders for $60,000 worth of sugar mill and other machinery. The sugar machinery is now being constructed by the Farrell Foundry and Machine Co., Ansonia, Conn. Included in this large purchase was $15,000 worth of boiler tubing from the National Tube Works, and considerable seamless brass tubing from the American Tube Works. Mr. Young is an experienced buyer and a good mechanic, and has heretofore bought all his machinery and supplies from England. Upon inquiry he found he could do much better in this country, both as to prices and quality. He has chartered a vessel which leaves New York about the middle of December.

We hear a great deal of carping about the policy of our government as retarding business, and every day the policy of Great Britain is pointed out as affording, by its adoption, on our part, a solution of all the difficulties that now beset trade. Looking at the matter from an unbiassed standpoint, as shown in its results, it is difficult to see how we should be benefitted by the substitution of British political economy, for our own present system. Iron, the great pillar of business, is as cheap in the United States as it is in England, and our furnaces, foundries, forges, rolling mills, and machine shops, are even more active than those in England, and less workmen are begging for employment, if we can credit the most reliable accounts received from the other side of the Atlantic. New foreign trade is constantly opening to us, while the English journals are sadly bewailing their lack of orders and loss of foreign customers, through our competition. The fact is that "reforming" the tariff, "remonetizing silver" and postponing the return to a "gold basis," have less to do with keeping back trade than the croaking of disappointed speculators. There is no naural reason why business should not be active and honest laborers find full employment. Nature has done her part of the work, in producing a bountiful harvest, and it only needs an increasing confidence on the part of those who have material and forces at their command to hasten the return to general prosperity. The government has less control over the condition of trade than many are led to believe by reading political speeches and essays, and listening to politicians. There are undoubtedly errors and peculations enough in governmental affairs, but to base all business success upon their correction would be ridiculous. The enterprise, energy and intelligence of the people of this country can be relied upon to correct public evils, and business need not suffer in consequence.

Machinists' Hand Taps.

V and Franklin Institute Shape of Thread.

3 TAPS TO SET—TAPER, PLUG AND BOTTOMING.

Diameter.	Price Each.	Diameter.	Price Each.
1-4	$0 45	15-16	$1 80
5-16	50	1	2 00
3-8	55	1 1-8	2 25
7-16	60	1 1-4	2 60
1-2	70	1 3-8	3 00
9-16	80	1 1-2	3 50
5-8	90	1 5-8	4 20
11-16	1 05	1 3-4	5 00
3-4	1 20	1 7-8	5 80
13-16	1 40	2	6 70
7-8	1 60		

Machine or Nut Taps.

V and Franklin Institute Shape of Thread.

LONG SHANK.

Diameter.	Price Each.	Diameter.	Price Each.
1-4	$0 60	15-16	$2 40
5-16	70	1	2 80
3-8	80	1 1-8	3 20
7-16	90	1 1-4	3 70
1-2	1 00	1 3-8	4 20
9-16	1 15	1 1-2	4 70
5-8	1 30	1 5-8	5 30
11-16	1 45	1 3-4	6 00
3-4	1 60	1 7-8	6 80
13-16	1 80	2	7 70
7-8	2 10		

Taps for Machine Screws.

Wire Guage, No.	Size.	Price Each.	Price per Doz.
4		35c.	$4 00
6		35c.	4 00
8		35c.	4 00
10		35c.	4 00
12		35c.	4 00
14		38c.	4 40
16		38c.	4 40
18		38c.	4 40
20		45c.	5 30
24		45c.	5 30

Solid Reamers.

Diameter of Reamer.	Price Each.	Diameter of Reamer.	Price Each.
1-4	$1 40	15-16	$3 80
5-16	1 55	1	4 10
3-8	1 70	1 1-16	4 50
7-16	1 85	1 1-8	4 90
1-2	2 00	1 3-16	5 30
9-16	2 20	1 1-4	5 70
5-8	2 40	1 5-16	6 10
11-16	2 60	1 3-8	6 50
3-4	2 90	1 7-16	7 00
13-16	3 20	1 1-2	7 50
7-8	3 50		

Grant's Patent Adjustable Tap-Wrench.

Drop Forged from Wrought.

No. 1, Fits 3-16 to 1-2 inch Taps	Price,	$4 50
No. 2, Fits 5-16 to 3-4 inch Taps	Price,	5 00
No. 3, Fits 1-2 to 1 inch Taps	Price,	7 50
No. 4, Fits 3-4 to 1 1-2 inch Taps	Price,	9 00

Prentiss' Screw Plates and Dies

Drop Forged-

No. 1, with 5 pair Dies 3-16, ¼, 5-16, ¾, 7-16 in. diameter,	$7 00
No. 2, with 5 pair Dies, ½, 9-16, ⅝, 11.16, ¾ in. diameter,	10 00
No. 3, with 5 pair Dies, 13-16, ⅞, 15 16, 1, 1¼ in. diameter,	15 00
No. 1 Plate will take Dies from 3-16 to ½ inclusive.	
No. 2 " " ⅜ to ⅞ "	
No. 3 " " ¼ to 1¼ "	
Single Dies, No,	$1 00
" No. 2,	1 25
" No. 3,	2 00

MORSE SCREW PLATES.

Size A, with 3 pair Dies	$5.00
" B, " 4 "	8.00
" C, " 4 "	10.00
" D, " 4 "	13.00
Single Dies, Size A	$1.00
" " " B	1.25
" " " C	1.75
" " " D	2.00

Clamp, Die, and Common Lathe Dogs.

Forged from Bar Steel and Hardened.

CLAMP DOG.

No, 1, 1¼ inch between Screws	$1 50
No. 2, 2¼ " " "	2 00
No. 3, 2¾ " " "	2 50
Price per Set of Three	5 50

DIE DOG.

1¼ inch between the sides	3 00
Extra Dies, 50 cents per pair	

COMMON DOG.

⅜ inch,	0 50
½ "	0 60
⅝ "	0 70
¾ "	0 80
1 "	0 95
1¼ "	1 10
1½ "	1 25
1¾ "	1 40
2 "	1 60
2½ "	1 80
3 "	2 00
3½ "	2 30
4 "	

Packer Ratchets.

No. 1, 10 inch handles,	$10 50
No. 2, 12 " "	13 50
No. 3, 15 " "	16 00
No. 4, 17 " "	19 00
No. 5, 20 " "	23 00

Boiler Ratchets.

No. 1, 10 inch handles,	$ 9 00
No. 2, 12 inch handles,	10 50

Auger Ratchets.

No. 1,	$7 00	Sockets,	$3 00
No. 2	8 00	Screw,	3 00

Machine Makers Screw Drivers.

Drop Forged From Best Cast Steel.

ROSEWOOD HANDLES.

No. 1, ¼ by 4 inch, per dozen,	$4 00
No. 2, ¼ by 4 inch, "	4 00
No. 3, 5 16 by 4 inch "	4 50
No. 4, ⅜ by 4 inch, "	5 50
No. 6, ½ by 6 inch, "	6 00

Star Try Squares.

No. 00.

CONCAVE IRON HANDLE, POLISHED STEEL BLADE, GRADUATED TO THE THIRTY-SECOND OF AN INCH.

4 inch, per dozen	$17 0
6 " "	19 0
8 " "	22 0
10 " "	28 0
12 " "	35 0

No. 0.

ROSEWOOD, INLAID, IRON BOUND HANDLE, POLISHED STEEL BLADE, GRADUATED TO THE THIRTY-SECOND OF AN INCH.

4 inch, per dozen,	$14 00
6 " "	16 00
8 " "	19 00
10 " "	25 00
12 " "	32 00

Patent Star Bevels.

Machinists No. 0.

IRON HANDLE, HEAVY POLISHDD STEEL BLADES, GRADUATED TO THE THIRTY-SECOND OF AN INCH.

6 inch, per dozen,	$10 00
8 " "	11 00
10 " "	12 00
12 " "	13 00

No. 1.

POLISHED ROSEWOOD HANDLES, HEAVY POLISHED STEEL BLADES, GRADUATED TO THE SIXTEENTH OF AN INCH.

6 inch, per dozen,	$8 00
8 " "	9 00
10 " "	10 00
12 " "	11 00

Machinists' Rules.

1 inch, per dozen,	$3 00
2 " "	4 20
4 " "	7 20
6 " "	7 20
6 " "	10 20
9 " "	15 00
12 " "	19 20
18 " "	30 00
24 " "	42 09
35 " "	72 00

Patent Star Calipers.

Outside or Inside.

3 inch, per dozen,	$7 50
5 " " "	10 00

Best Oak-Tanned Leather Belting.

Inches.	Per Foot.	Inches.	Per Foot.
1	$0 09	13	$1 53
1¼	12	14	1 65
1½	15	15	1 80
1¾	18	16	1 94
2	21	17	2 10
2¼	24	18	2 26
2½	27	19	2 42
2¾	30	20	2 58
3	33	21	2 74
3½	39	22	2 90
4	45	23	3 06
4½	51	24	3 22
5	57	26	3 56
5½	63	28	3 90
6	69	30	4 22
7	81	32	4 54
8	93	44	4 86
8	1 05	36	5 18
10	1 17	40	5 82
11	1 29	44	6 46
12	1 41	48	7 10

ROUND BELTS.

	Solid.	Twist.
1-8 Inch	.05	.05
3-16 "	.07	.09
1-4 "	.10	.12
5-16 "	.14	.16
3-8 "	.18	.20
1-2 "		.25
5-8 "		.30
3-4 "		.38
1 "		.53

Double Belts, twice the Price of Single. Intermediate Widths at Proportionate Prices. Extra heavy Belts Extra Prices.

Rubber Belting.

	3 Ply	4 Ply		3 Ply	4 Ply
2 inch,	$0 17	$0 21	12 inch,	$1 08	$1 30
3 "	26	31	13 "	1 18	1 42
4 "	34	25	14 "	1 28	1 54
5 "	43	52	15 "	1 38	1 66
6 "	52	62	16 "	1 50	1 78
7 "	60	73	18 "	1 70	2 02
8 "	70	84	20 "	1 90	2 26
9 "	80	95	22 "	2 12	2 52
10 "	90	1 07	24 "	2 36	2 80
11 "	1 00	1 18			

Twist Drills.

1-4	$ 65	25-32	$2 60
9-32	70	13-16	2 80
5-16	75	27-32	3 00
11-32	80	7- 8	3 20
3- 8	85	29-32	3 40
13-32	90	15-16	3 60
7-16	1 00	31-32	3 80
15-32	1 10	1	4 00
1- 2	1 20	1 1-32	4 20
17-32	1 30	1 1-16	4 40
9-16	1 40	1 3-32	4 60
19-32	1 50	1 1- 8	4 80
5- 8	1 65	1 5-32	5 00
21-32	1 80	1 3-16	5 25
11-16	2 00	1 7-32	5 50
23-32	2 20	1 1-4	5 75
3- 4	2 40		

Iron Market.

NEW YORK, Nov. 20, 1877.

PIG IRON.—As the time draws near for the close of river navigation sales are more frequent for immediate delivery. Taken in all its bearing the market presents a better feeling, though prices remain irregular, being governed by brand, quantity, and whether sold for sharp cash or on time. A few favorite brands of No. 1 are scarce and extra prices are asked for prompt delivery. The Thomas Iron Co., with seven furnaces now in blast, have sold ahead so as to be virtually out of the market. Stocks are light except at some furnaces on the Hudson. There is no probability of a general advance in Pig Iron this year, nor is there any prospect of a decline. Some good Lehigh brands of No. 1 can be had at $18, while others are held at $19 and $20. Hudson River Irons can be had at $17 for No. 1, on the furnace bank. General quotations are: $18 to $19 for No. 1; $17 to $18 for No. 2; $16.50 to $17 for grey forge, $16 for white and mottled. We hear of sales within a week amounting to nearly 2,000 tons Nos. 1 and 2 at the above figures.

Special sales reported as follows: 300 tons No. 1 Millerstown, part at $20 sharp cash, and part at $21, usual time; 100 tons Selected No. 1 Coleraine, $20; 300 tons No. 1 Coleraine, $19; 50 tons No. 2 Coleraine, $18; 300 tons No. 1 Lehigh, $19; 80 tons No. 2 Sterling, $17; 50 tons No. 1 (plain) Sterling $17.50 100 tons Sterling forge $16.50 100 tons Sterling, mottled, $16, and 50 tons No 1. Oxford, on private terms.

SCOTCH PIG.—Some 600 tons arrived during the past week as follows: 100 tons each of Eglinton, Glengarnock, Carnbroe and Summerlee, and 200 tons of Coltness. All this was promptly sold from ships side.

MANUFACTURED IRON.—The demand is fair, though not as brisk as could be desired. Through freights from the West have advanced 6c. per hundred pounds, which gives the iron market an upward tendency, especially on large orders. A good quality of refined iron can not be obtained from stock in store at less than 2c. per lb., and in car-load lots at less than 1.95c per lb., laid down on dock in this city. Common Iron made from old rails sells at $37 a ton. The Pittsburgh mills sell in 100 ton lots at 1.75c to 1.80c for refined bar, at mill.

A great deal of old Rail Iron has been sold at low prices under the name of refined, but consumers are getting more cautious.

WROUGHT SCRAP.—Late sales of 700 tons at $22 to $23, according to selection. The general price is $22 at yard.

RAILS.—Since the failure of the Bessemer Steel manufacturers to unite on a scale of prices the trade has been demoralized. Two East Pennsylvania establishments have been running against each other on prices until some of the other mill owners talk of shutting down rather than lose money.

Within thirty days several thousand tons of Steel Rails have been sold at from $40 to $43, at mill. Purchasers have been more active than for many months before. No new Iron Rails are selling worth mentioning, and are not likely to be in demand while Steel remains so low. Old Rails sell in small lots at $18.50 to $19.

STEEL.—The demand is fair, but prices are very low. More Steel is selling than at this time a year ago. All the Steel Works of Pittsburgh are in full operation, also those in this immediate vicinity.

We quote on the average, American Tool Steel, 13c; English do, 15c; American Machinery Steel, 7c; English do. 9c.

Patent Portable Hoisting Machines.

Price List.

In ordering chains allow 2 feet of chain to each foot of lift.

To lift.	To raise.	Price.	ex. p. ft
8 ft.	500 lb.	$22.50	$1.00
8	1,000 "	25.00	1.20
8	2,000 "	30 00	1.50
8	3,000 "	40.00	1.75
9	4,000 "	60.00	2.00
10	6,000 "	75.00	2.20
10	8,000 "	95.00	2.40
12	12.000 "	150.00	3.75
12	16,000 "	225.00	4.75
12	20.000 "	300.00	6.00

Edwin Harrington & Son.

ALSO

Manufacturers of Machine Tools Fifteenth St. & Pennsylvania Ave.

PHILADELPHIA.

W. & B. Douglas,

MIDDLETOWN,

CONN.

Branch Warehouses, 85 and 87 John Street, New York, and 196 Lake Street, Chicago,

MANUFACTURERS OF

PUMPS,

Hydraulic Rams, Garden Engines, Pump Chain and Fixtures, Iron Curbs, Yard Hydrants, Street Washers, &c.

WORKS FOUNDED IN 1832

Highest Medal Awarded them by the Universal Exposition at Paris, France, in 1867, and Vienna, Austria, in 1873.

RICHARD DUDGEON,

24 Columbia Street,

NEW YORK.

Maker and Patentee of

IMPROVED HYDRAULIC JACKS,

Punches and Roller Tube Expanders.

and

DIRECT ACTING STEAM HAMMERS

Communications by letter will receive prompt attention.

Jacks for Pressing on Car Wheels or Crank Pins made to order.

Daniel Ames

PEN ARTIST,

AND PUBLISHER OF THE

Penmans' Art Journal,

205 Broadway, N. Y.

Executes every class of Pen Work in the best style of the Art.

Drawings for Photo-Engraving and Photo-lithography a Specialty.

WANTED.—Capital wanted to manufacture a good Machine, which is developed and patents secured, by a party who has the trade and business organized to proceed at once. Address J., care of AMERICAN MACHINIST.

JOHN ROBERTSON & CO.,

Tubal Cain Iron Works,

MANUFACTURERS OF

Hydraulic Presses

AND

PUMPS

OF EVERY DESCRIPTION.

Lead Pipe, Sheet Lead, and White Lead Machinery.

Machinery in General.

127, 129 & 131 Water Street,

Brooklyn, N. Y.

FRASSE & CO.

62 Chatham Street,

New York.

Importers and Manufacturers

Fine Tools. Files, Steel Wire and Supplies for Machinists and other metal workers.

SOLE AGENTS FOR THE

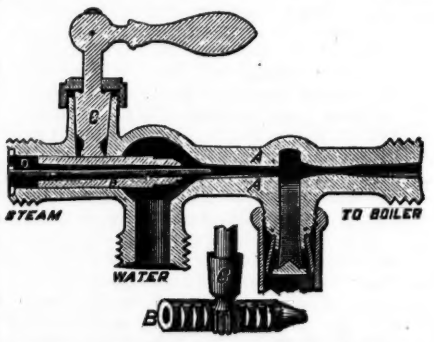
Etterick Drill Chuck.

A Chuck that will not let the drill slip.

Send for Circular.

THE

KEYSTONE INJECTOR.



Cheapest and best known Boiler Feeder in the market. Its advantages over all others are its *Simplicity*. It is not affected by over-heating. It has no Packing and Stuffing Boxes. No extra fittings required for *Lifting* and *non-Lifting* Injectors. Manufactured by

E. TRACY,

922 Cherry St., Phila., Pa.

VOLUNTARY TESTIMONIAL.—Extract from letter with check for $82.50 in payment for two Injectors.

SCRANTON, PA., June 30th, 1877.

MR. E. TRACY, *Dear Sir*: One of these Injectors furnished by you was placed to feed through over *fifty feet* of 1¼ inch pipe, with *six right angles*, and a *six pipe heater* with *five return bends*, and it has never failed to work. Both give *perfect satisfaction*.

Yours respectfully, FINCH & CO.

The Keystone Injector may be ordered direct from the factory, or from most of the machinery supply houses in the United States and Canada.

☞ Send for Circular and Price List.

Pattern Letters,

ALL SIZES

From ⅛ inch up to 6 inches.

The peculiar features of my Letters are uniformity of Bevel, Symmetry and Proportion combined harmoniously.

Will Cast in Iron as Fine as Type.

Founders and others can be immediately supplied at whole sale rates by return of mail.

100 different sizes and kinds

Illustrated catalogue sent on application. Address

S. E. ADAMSON,

3 Park Place, - - - NEW YORK

Address P.-O. Box 2187. **PIERSON & CO.,** Office, 24 Broadway, N. Y.

Established 1790.

IMPORTERS AND DEALERS IN IRON AND STEEL OF EVERY DESCRIPTION,

Warehouse, 24 and 26 Broadway and 77 and 79 New Street,

New York City, November 20, 1877.

TERMS NET CASH IN 30 DAYS. PRICES SUBJECT TO MARKET CHANGES WITHOUT NOTICE.

COMMON IRON.

	Price per lb.
1 × 3/8 to 6 × 1 Flat	1 8/10
1 1/2 to 6 × 1/4 and 5/16 Flat,	1 9/10
1 and 1 1/2 × 1/4 and 5/16 Flat,	
3/4 and 2 Round and Square,	1 8/10
5/8 and 11/16 " "	1 9/10
1/4 and 9/16 " "	2

REFINED IRON.

1 × 3/8 to 6 × 1 Flat,	2
1 to 6 × 1/4 and 5/16 Flat,	2 2/10
3/4 to 2 Round and Square,	2
2 1/16 to 2 7/16 " "	2 2/10
3 to 3 1/2 " "	2 4/10
3 5/8 to 4 "	2 7/10
4 1/16 to 4 1/2 "	3
4 5/8 to 5 "	3 3/10

RODS, ROUND AND SQUARE.

2 1/10	2 2/10	2 6/10	2 8/10	2 9/10	3 1/10	4 2/10

Ovals, Half Ovals & Half Rounds.

5/8 & 11/16	1/2 & 9/16	7/16	3/8	5/16	1/4	3/16

2 6/10	2 8/10	3	3 5/10	3 7/10

BAND. HOOP.

3/4 to 2	5/8 & 11/16	1/2 & 9/16	7/16	3/8

1 to 6 × 3/16 to No. 12 - 2 4/10

5 8/10	4 4/10	3 6/10	3 4/10	3 1/10	2 9/10	2 7/10

HORSE SHOE.

1/2	5/8	3/4	7/8	1	1 1/4	1 1/4 & up'ds

3/4 × 3/8 to 1 1/8 × 5/8 - - 3 3/10

SCROLL.

4 6/10	4 5/10	4 3/10	3 8/10	3 6/10	3 4/10
1/2 × 16	14	12	10	3/16	1/4 & 5/16
4 2/10	3 8/10	3 5/10	3 3/10	3 1/10	2 9/10
5/8 × 16	14	12	10	3/16	1/4 & 5/16
3 4/10	3 2/10	3	2 9/10	2 8/10	2 7/10
3/4 × 16	14	12	10	3/16	1/4 & 5/16
3 2/10	3 1/10	2 9/10	2 8/10	2 7/10	2 6/10
7/8 × 16	14	12	10	3/16	1/4 & 5/16

	c.
Norway Bar Iron,	5
" Shapes,	6
Nail Rods, P. & Co., 6c., or U. B.	6 1/3
Angle Iron,	2 1/2
Tee Iron,	3
Sheet Iron Common,	2 9/10
Boiler Plate,	
Best Flange,	

EXTRA REFINED IRON.

Equal to H. B. & S. B. B. H. BAG-NALL'S or L. W.

Ordinary Sizes.

	Price per lb.
ROUND AND SQUARE. 3/4 to 2 in.	2 5/10 c.
FLATS. 1 × 3/8 to 6 × 1,	

Extras same as Refined.

ULSTER BEST IRON.

PIERSON & CO., keep in Stock a full assortment of this well known extra brand.

Ordinary Sizes.	Price per lb.
3/4 to 2 Round and Square, 1 1/4 × 3/8 to 4 1/2 × 1,	3 5/10 c.

Extras on Rounds and Squares.

1/4	1 3/10	5/8 and 11/16	2/10
5/16	1 1/10	2 1/8 to 2 3/8	2/10
3/8	8/10	2 1/2 to 3	4/10
7/16	6/10	3 1/4 to 3 1/2	6/10
1/2 and 9/16	4/10	3 3/4 to 4	8/10

Extras on Flats.

	1 3/10	1 1/10	8/10
5/8 × 1/8 and 3/16	1 1/10	1/4 and 5/16	3/8 to 1/2
3/4 × 1/8 and 3/16	8/10	1/4 and 5/16	3/8 to 5/8
7/8 × 1/8 and 3/16	6/10	1/4 and 5/16	3/8 to 3/4
1 × 1/8 and 3/16	4/10	1/4 and 5/16	3/8 to 7/8
		3/10	2/10

1 1/8 × 1/8 and 3/16	1/4 and 5/16	3/8 to 1	
1 1/4 to 4 1/2 × 1/4 and 5/16, × 1 1/8 to 2			2/10
4 3/4 to 6	3/8 to 1,		
4 3/4 to 6	1/4 and 5/16,		
"	1 1/8 to 2,		4/10
6 1/4 to 7	3/8 to 1,		
2 1/4 to 3	2 1/8 to 2 3/4,		
6 1/4 to 7	1/4 and 5/16,		
"	1 1/8 to 2,		6/10
3 1/4 to 4	2 1/8 to 3,		

Ovals.

8/10	8/10	4/10	2/10
1/2 and 9/16	5/8 and 11/16	3/4	7/8 & up.

Half Ovals and Half Rounds.

1 3/10	1 1/10	8/10	4/10
1/2 and 9/16	5/8 and 11/16	3/4	7/8 and up.

Ulster Horse Shoe. - - 3 5/10

MISCELLANEOUS.

Special Rates Given On Application.

Iron and Steel Rails; Railroad Chairs and Spikes; Railroad Fish Plates; Bolts, &c.; Railroad Axles and Wheels; Wire Rods; Screw Rods; Gas and Steam Tubes; Nails; Rivets; Tank Iron. Wrought Iron Beams, Deck Beams, Channel Bars, Star Iron, Octagonal Post Iron, "Upset" Chord Bars; Angle and Tie Iron.

"Universal Mill" Plates.

Plates not over 24 in. wide, × 3-8 to 7-16
Plates not over 24 in. wide, × 1-2 and upw'ds
Plates not over 24 in. wide, × 3-16 to 5-16.

All plates over **30** feet long, weighing **1000** lbs. or over, subject to **special agreement only.**

These Plates are not Sheared.

Edges guaranteed perfectly solid, straight and of uniform width, rendering reshearing unnecessary when exactness is required.

Railroad, Drifting, Pall, Coal and Mining Picks of our own manuf

STEEL,

Foreign and Domestic

English	Cast Steel,	15c
"	Spring Steel,	6
"	Tire "	6
"	Toe Calk Steel,	6
"	Machinery Steel,	9
"	Bessemer Wire Rods,	
American	Bessemer Tire Steel,	
"	3-16 up,	5c.
"	" " 5-32 up.	5 1/4
"	" " 1-8 "	5 1/4
"	" " 3-32 "	5 1/4
"	Spring Steel,	5
"	Tool "	13
"	Machinery Steel,	7
"	Toe Calk Steel,	5
"	Plow Steel,	6
"	Sleigh Shoe Steel,	4
"	Bessemer Steel,	7
"	Steel Crowbars,	6 1/4

STEEL FORGINGS TO ORDER.

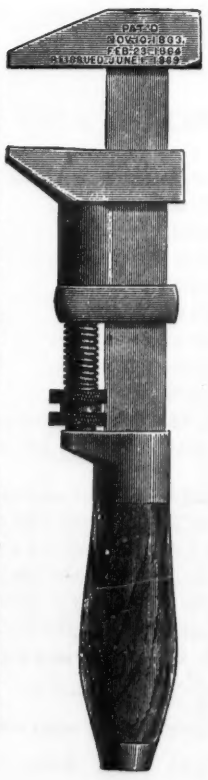
L. COES & CO.,

Worcester, - - - - Mass.,

Patented November 10, 1863, and February 23, 1864, Re-issued June 1, 1869.

Improved August 1, 1877.

WARRANTED EQUALLY AS STRONG AS OUR GENUINE.



MANUFACTURERS OF

L. COES'

Genuine Improved

AND MECHANICS'

Patent

SCREW WRENCHES.

Taking in view the fact that the larger number of our Wrenches are used by those who require a strong, serviceable tool, rather than one highly finished and more expensive, we have added the MECHANICS to our manufacture.

L. COES & CO.

HORACE DURRIE & CO., Agents.

97 Chambers and 81 Reade Streets

NEW YORK.

PLUMBAGO-"BLACK-LEAD"-GRAPHITE.

STANDARD UNEQUALLED GRADES PERFECTED EXPRESSLY FOR

Crucibles, Stove Polish, Powder, Shot and other Glazing; Foundry Facings, Pencils, Electrotyping, Piano-action, Paint, &c., and for Lubricating Machinery of every description.

GRADES FOR SPECIAL USES PREPARED TO ORDER.

Hot Journals avoided and Minimum Friction assured by using the original

"Perfect Lubricator,"

(Plumbago of absolute and unequalled purity.)

Scientifically Prepared and Tested, showing a Lubricating Power seven to nine times greater than Best Sperm Oil.

Sound, Smooth and Perfect Iron or Brass Castings

ASSURED BY USING THE

"Founder's Perfect Wash,"

For Dry Sand and Loam Moulds.

Iron, Tin and Metal Work permanently protected against rust by using the Unchangeable, Economical,

"PLUMBAGO PRESERVATIVE PAINT."

American Graphite Company,

No. 24 CLIFF ST., NEW YORK.

CYRUS BUTLER, PRESIDENT. F. W. POTTER, SECRETARY.

Mines and Works, Ticonderoga, N. Y

VICTOR SEWING MACHINE COMPANY,
Middletown, Conn.,

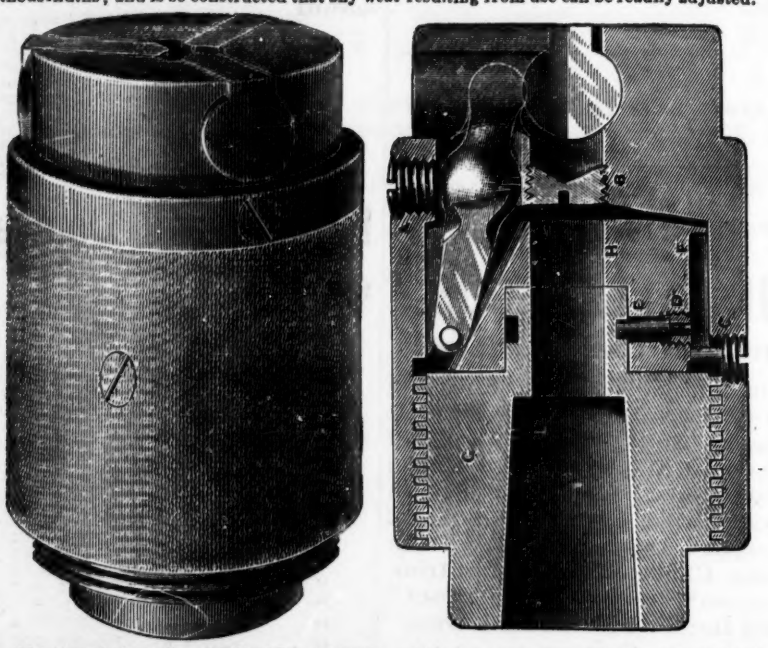
MANUFACTURERS OF THE

MICROMETER CALIPER.

Price, $5. In Morocco Case, $6.

This attractive and very desirable tool will be found more reliable and convenient than the Vernier Caliper, and to Machinists and Tool-makers it is indispensable on work requiring very accurate and close measurement. *This feature is guaranteed.*

Its capacity is one inch, and is graduated to one-thousandths, but can readily be set one-half and quarter thousandths; and is so constructed that any wear resulting from use can be readily adjusted.

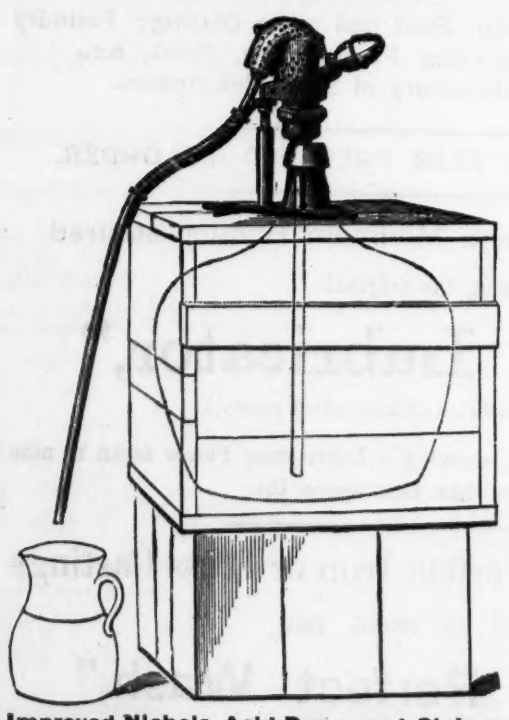


We also manufacture the "VICTOR" CHUCK, which has the commendation of accomplished machinists as possessing superior qualities. It is adjustable, self-tightening, and the clutches being flush with the face, renders it more convenient for the workman than any other, and less liable to be broken.

The Nichols
ACID PUMP AND SIPHON,

IS UNRIVALLED IN THE WORLD.

It received the highest and only Award for its kind, from the Judges at the Centennial Exposition, Philadelphia, in competition with the world.



Improved Nichols Acid Pump and Siphon.

Patented March 18, 1873, and March 28, 1876.

THE OLD WAY.

THE NEW.

Above engravings give a fair idea of the NICHOLS' ACID PUMP AND SIPHON, for Sulphuric Acid or Oil Vitriol, as it appears ready for use (the lines showing the carboy). The Pump itself is of heavy glass, entirely enclosed in Iron with substantial Lead Pipes. The oil vitriol comes in contact only with lead and glass. The whole is light, strong and durable.

There is no attaching, no disengaging. It is ready as soon as dropped into the carboy for immediate use, and is transferred to another carboy with equal ease. A child can manage it.

No continuous pumping is required. Once set in motion the acid flows through it until stopped, thus giving safely and quickly any quantity from a wine glass full to the contents of the carboy. Does not imperil the Carboy.

Manufacturers whose attention has been called to the simplicity, cheapness, and adaptedness of the Nichols No. 3 to its work, have been quick to avail themselves of its benefits. A single firm frequently ordering two or three at once for one kind of acid, where they had as many carboys on tap.

MANUFACTURED BY

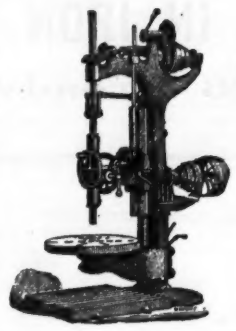
ACID PUMP AND SIPHON CO.,

AND FOR SALE BY

W. M. B. HAMMOND & CO., AGENTS,

34 Warren Steet, N. Y. City.

Fitchburg Machine Works,

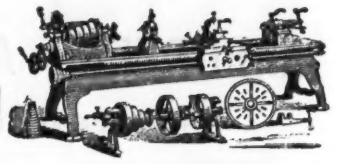


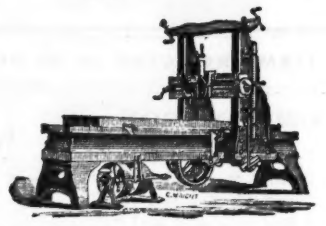
MANUFACTURERS OF

Machinery and Machinists' Tools,

17, 19 and 21 Main Street,

FITCHBURG, MASS.





Warerooms:

720 and 722 Filbert St., Philadelphia, Pa.

THE HASKINS ENGINE,

FITCHBURG STEAM ENGINE CO.,

FITCHBURG, MASS., U. S. A.

Manufacturers of 2 to 100 Horse Power.

Engines AND **BOILERS.**

Combined as in cut to 12 horse-power, or entirely independent

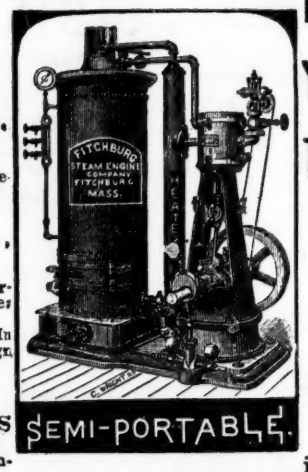
ALL STYLES AND SIZES.

All parts made strictly interchangeable by use of jigs, gauges and special machinery.

Materials warranted first-class. In use everywhere in this and foreign countries.

Large Engines

Specially designed for economy simplicity and durability.



Launch Engines

Yacht Engines,

Tug-Boat Engines,

WITH

Steel Boilers.

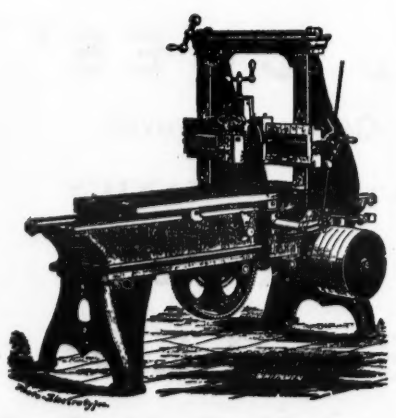
Warranted the best made in the world.

Send for pamphlet giving details and say where you saw this.

Established 1847.

DAVID W. POND,

SUCCESSOR TO LUCIUS W. POND,



Manufacturer of

MACHINISTS' TOOLS,

Worcester, - Mass.

☞ Send for Catalogue.

AMERICAN
IRON WORKS.

JONES & LAUGHLINS,

PITTSBURGH, PA.,

MANUFACTURERS OF

AMERICAN AND CLAIR

BAR, HOOP, SHEET and PLATE IRON,
BRIDGE IRON,
ANGLE IRON,
PLOW BEAM IRON,
GUARD IRON,
COAL SCREEN IRON,
CUT NAILS and SPIKES,
SHIP and BOAT SPIKES,
RAILROAD SPIKES,
T RAIL, 8, 12, 16, 20, 28, and 40 lbs. to yard,
STREET RAIL, 23, 27, 32 and 45 lbs. to yard,
TRAM RAILS, punched and countersunk,
RAILROAD FISH BARS and BOLTS,
COAL PIT CAR WHEELS and AXLES,
PATENT COLD ROLLED SHAFTING,
PATENT COLD ROLLED PISTON RODS,
FINGER BARS and KNIFE BACKS,
PULLEYS, HANGERS and COUPLINGS.

WAREHOUSE AND OFFICE,

Second and Third Aves, and Try St.,

BRANCH OFFICES,

Nos. 190 to 196 South Canal Street,

CHICAGO, ILL.

Nos. 133 to 139 West Water Street,

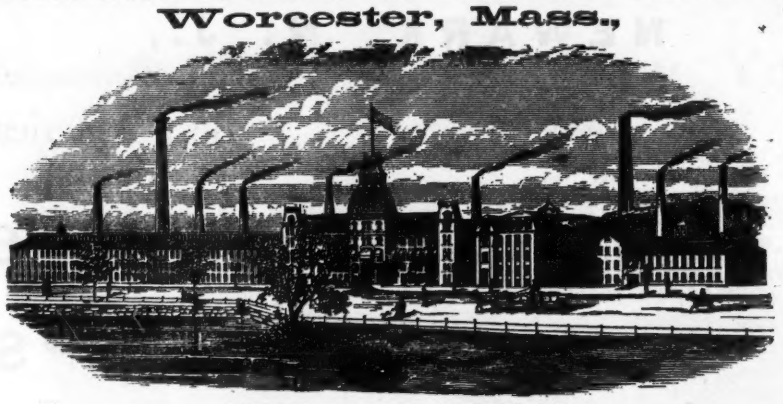
MILWAUKEE, WIS.

PHILIP L. MOEN, Pres. and Treas. CHAS. F. WASHBURN, Vice-Pres. and Sec.

ESTABLISHED 1831.

WASHBURN & MOEN MANUFACTURING CO.,

Worcester, Mass.,



MANUFACTURERS OF ALL DESCRIPTIONS OF

Iron and Steel Wire for Machinists Purposes,

For Export and Domestic Trade.

Warehouse, 42 Cliff Street. New York.

NEWARK

STEEL WORKS.

Benjamin Atha & Co.,

Manufacturers of

CAST STEEL,

We make grades of steel specially adapted to the manufacture of Lathe Tools, Chisels, Taps and Dies.

NEWARK,

NEW JERSEY.

BENJ. ATHA. J. ILLINGWORTH.

L. SMITH HOBART, President. JOHN C. MOSS, Superintendent.

NEW METHOD OF ENGRAVING

Moss' Process.

Photo Engraving Co.

67 Park Place, New York.

RELIEF PLATES

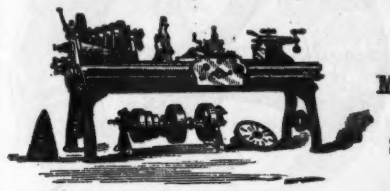
For Newspaper, Book and Catalogue Illustrations, Engraved in Type-metal, by a new Photo-Chemical method, from all kinds of Prints, Pen Drawings, Photographs, Original Designs, &c., MUCH CHEAPER THAN WOOD-CUTS These Plates have a perfectly smooth printing surface, and the lines are as deep, as even, and as sharp as they could possibly be cut by hand. We guarantee that they will print satisfactorily on wet or dry paper, and on any press where type or wood-cuts can be so printed. Electrotypes may be made from them in the usual way.

Our Plates are now used by the principal publishers and manufacturers in every State in the Union.

SEND STAMP FOR ILLUSTRATED CIRCULAR.

Established, 1838.

PUTNAM MACHINE CO.,



MANUFACTURERS OF

Machinists' Tools,

Steam Engines,

Woodworth

Planers,

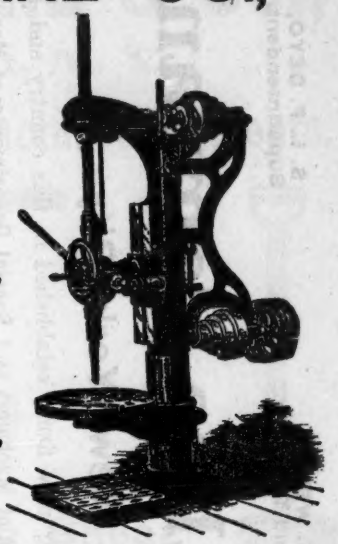
Water Wheels,

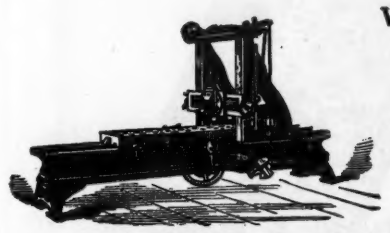
Mill Works,

Shafting, &c.,

FITCHBURG,

MASS.





SALESROOM, 115 LIBERTY STREET, NEW YORK.

MALTBY, CURTIS & CO.,

34 Reade Stret, New York,

MANUFACTURERS OF

Saunder's Patent Metallic Corrugated Packing for Steam,

Air, Gas or Water Joints, and all kinds of Union Coupling.

Nos. 1, 2 & 3 Wire.

Cuts show the Corrugated Wire Packing, as sold in bundles.

SEND FOR CIRCULAR.

Sample Gasket or Wire sent free by mail, on application.

This Packing has been thoroughly tested, and is now coming into general use, both on Ocean Steamers, Railroads and Stationary Engines throughout the country. It has also been thoroughly tested by a heavy pressure of steam, that no other Packing could withstand. It is evident to every good mechanic that it is a cheaper and better Packing than any other now in use, and requires only to be known to be used. For Steam Engines, Water Pipes, Gas Pipes and pipes of every description, it has no equal. The joints will not leak, and the Gasket will not burn out, neither can it be blown out. It will last as long as the material that it connects.

NEW YORK BELTING AND PACKING COMPANY,

The oldest and largest manufacturers in the United States of

Vulcanized Rubber Fabrics.

IN EVERY FORM, ADAPTED TO

MECHANICAL PURPOSES.

COMPRISING

MACHINE BELTING with smooth metallic rubber surface.
STEAM PACKING in every form and variety.
LEADING AND SUCTION HOSE, of any size or strength.
PATENT "SMOOTH BORE" RUBBER SUCTION HOSE.
"TEST" HOSE.—This extra quality of Hose is made expressly for Steam Fire Engine use, and will stand a pressure of 400 lbs. per square inch.
ANTISEPTIC LINEN HOSE, a cheap and durable Hose for mill and factory purposes.
ANTISEPTIC RUBBER-LINED LINEN HOSE, the lightest Hose manufactured for use on Hand or Steam Fire Engines. Will stand a pressure of 300 lbs. per square inch.
CAR SPRINGS of a superior quality, and of all the various sizes used.
SOLID EMERY VULCANITE WHEELS, for grinding and polishing metals—the ORIGINAL Solid Emery Wheel, of which all other kinds are imitations and greatly inferior.

CAUTION.

Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest.

WAREHOUSE, 37 and 38 PARK ROW, NEW YORK.

JOHN H. CHEEVER, Treasurer.

Price-lists and further information may be obtained by mail or otherwise on application.

FREELAND TOOL WORKS.

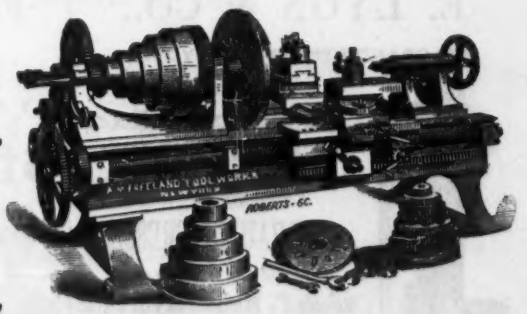
THOMAS & CO.,

558 and 560 West Thirt-fourth Street,

NEW YORK CITY,

MANUFACTURERS OF

Machinists' Tools,
Mining, Hydraulic and Experimental Machinery,
Patent Office Models,
Surface Plates,
Standard Guide Screws and Special Tools,



ALSO MANUFACTURERS OF

Thomas's Patent Planer Vise,

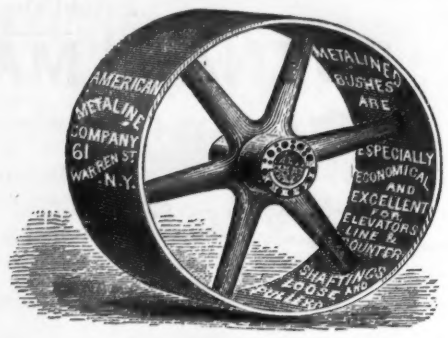
THE BEST IN THE WORLD. SEND FOR CIRCULAR.

STUART GWYNN, M.D., Vice-President and Manager.
EBEN F. WELLS, Secretary and Treasurer.
S. L. F. DEYO, Superintendent.

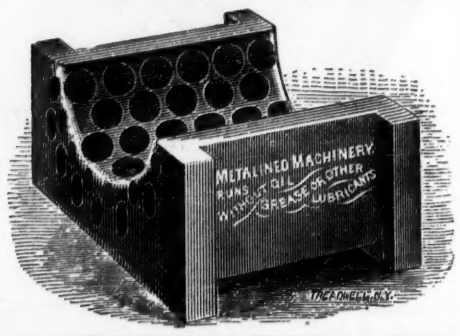
American Metaline Company,

61 Warren · Street, New York City.

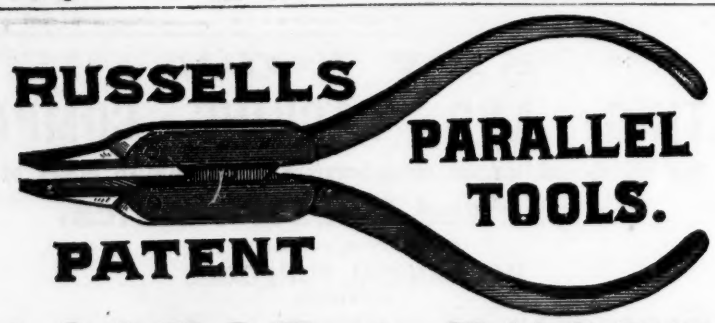
The reputation of Metaline and Metalined Bushes being now firmly established in this country and Europe, Exclusive Licenses for their use in Special Machines, Classes of Machinery and Special Departments of Manufactures will be granted on terms that will be made satisfactory to the right parties.


AMERICAN METALINE COMPANY 61 WARREN ST. N.Y.
METALINED BUSHES ARE
ESPECIALLY ECONOMICAL AND EXCELLENT FOR ELEVATORS, LINE & COUNTER
SHAFTINGS LOOSE AND PULLEYS

METALINED IS USED AND COMMENDED BY EXPERIENCED MECHANICAL ENGINEERS IN THE U.S.
SEND FOR LETTERS AND DESCRIPTIVE CIRCULARS.
LONG AND SEVERELY TRIED IN GIBS & CROSS HEAD BRASSES



RUSSELLS PATENT PARALLEL TOOLS.

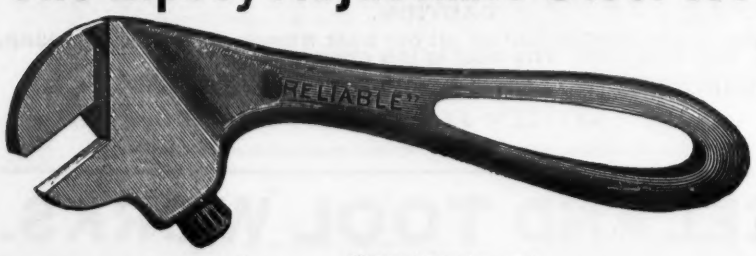


HAGSTOZ & THORPE,

Sole Manufacturers.

Sixth and Chestnut, PHILADELPHIA.

The Lipsey Adjustable Steel Wrench.



Strongest, Cheapest, Best and Most Convenient.

MANUFACTURED BY

The Roper Caloric Engine Manufacturing Co.,

91 WASHINGTON STREET, NEW YORK.

E. LYON & CO.,

470 GRAND STREET, NEW YORK.,

Manufacturers of

Hydraulic JACKS AND PUNCHES,

For Raising Heavy Weights, Punching Iron, &c,

HYDRAULIC PRESSES

On hand and made to order.

Second-Hand Hydraulic Presses Bought and Sold.

Machinery for Polishing and Buffing Metals.

Send for Circular.

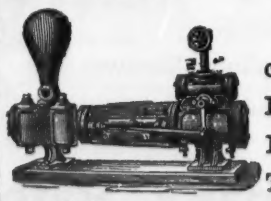
E. LYON. T. H. WATSON. F. H. STILLMAN.

Foster & Jamieson,

MANUFACTURERS OF THE

JAMIESON PATENT

Steam Pump,



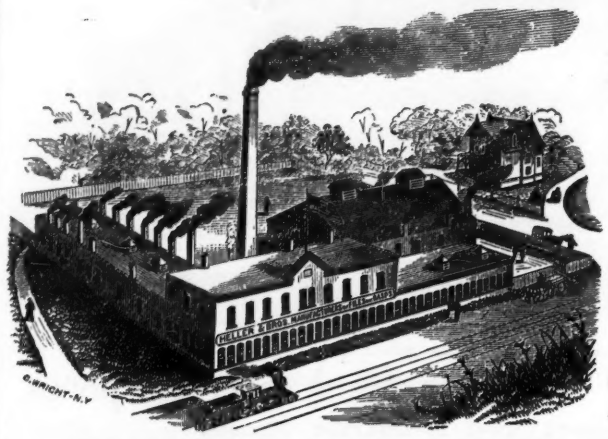
Foster's "Excelsior" Rotary Pumps, Foster's Patent Screw Taps.

13 Adams Street, Brooklyn, N. Y.

WM. FOSTER. H. A. JAMIESON.

HELLER · & · BROTHERS,

NEWARK, N. J.,



MANUFACTURERS OF

Best American HAND-CUT FILES AND RASPS.

Guarranteed to give entire satisfrction.

FOR SALE BY ALL LEADING HARDWARE AND IRON HOUSES.

THE GEORGE PLACE

Machinery Agency.

IRON AND **WOOD-WORKING** Machinery,

OF EVERY DESCRIPTION.

Cold Rolled Shafting

121 Chambers AND 103 Reade Streets,

NEW YORK.

AGENCY FOR

Jones & Laughlins' Cold Rolled Shafting.
Cranes' Patent Hangers.
W. B. Bement & Son. Machinists Tools.
P. Blaisdell & Co., Machinists Tools
New Haven Manufacturing Co., Machinists Tools.
American Tool and Machine Co., Fox Lathes, &c.
Brown & Sharp, Milling Machines, &c.
J. A. Fay & Co., Wood-Working Machinery.
Harris-Corliss Engine.
Wm. Wright's Patent Cut-Off Engine.
B. F. Sturtevant, Blowers.
G. H. Deane & Co., Steam Pumps.
The Tanite Co., Emery Wheels and Machinery.
Patterson's Forges.

Chucks of all kinds. Twist Drills, Leather and Rubber Belting. Perin's Band Saw Blades. Patent Combination Lathe, &c.

SYNOVIAL

Lubricating Oil

THE MOST

DURABLE, RELIABLE,

AND

Economical Lubricant

IN EXISTENCE.

Applicable to every grade of Machinery.

MANUFACTURED EXCLUSIVELY BY THE

LESTER OIL CO.,

81 MAIDEN LANE,

New York.

SEND FOR CIRCULAR AND PRICE LIST.

ESTABLISHED 1854.

John H. Thompson & CO.,

IMPORTERS OF

SCOTCH PIG IRON.

AND AGENTS FOR

Standard Brands,

American Pig Iron.

IRON ORES,

Iron and Steel Rails,

BAR IRON, NAILS, METALS

&c.

Anthracite and Bituminous Coal.

32 Pine Street,

P.-O. Box 163, NEW YORK

TANGYE'S HYDRAULIC **JACKS,**

Best and cheapest in the market, and the easiest to work. No valves to stick in lowering.

Weston's Ratchet Drills, Salter's Loco Balance Wrought Iron Tackle Blocks for Rope, Wire Rope or Chain.

Duplex Punches—open mouth.

McCoy & Co.,

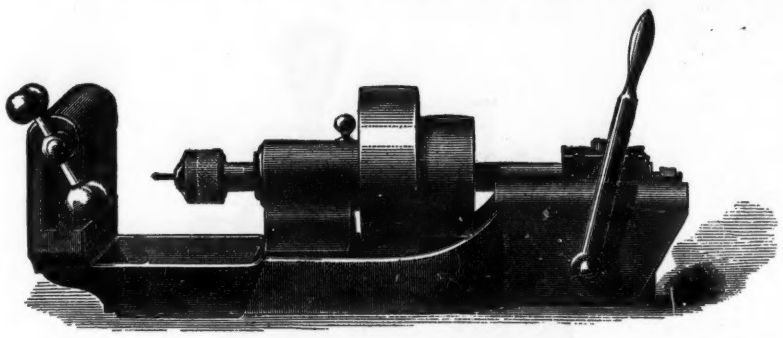
134 Duane Street, New York.

WE ENAMEL in FINE JET BLACK every variety of turned woodwork parts of machinery, castings, tin ware and other metal work. ENAMELED JET GOODS, in wood or metal, made to order. AMERICAN ENAMEL CO. 17 WARREN ST. PROVIDENCE, R. I.

The Bullard Machine Co.,

(LIMITED)

No. 14 Dey Street, New York,



DEALERS IN NEW AND SECOND-HAND

Iron Working Tools and Steam Engines.

We have on hand One 30 in. x 6 ft. Pond Planer, One 27 in. x 6 ft. Ferris & Mile do., One 8 in. N. Y. S. E. Co.'s Shaper, One 10 in. Ferris & Miles do., One 30 in Upright Drill, One 28 in. do., Feed and Back Gears, Two 18 in. do., One Brown & Sharpe Universal Milling Machine, two Smith & Garvin Milling Machines for job work, good as new. Seven Pratt & Whitney No, 2 Milling Machines for set work, One Putnam Machine Co.'s Gear Cutter, lot 14 and 16 in. lathes, 5, 6, and 8 foot beds, Three Sellers' Bolt Cutters, One Wiley & Russell do., to cut ½ to 1½ in. bolts, Lot of Improved Centering Machines, same as cut.

STERLING IRON AND RAILWAY CO.,

42 PINE STREET, NEW YORK.

PIG IRON and IRON ORE.

A. W. HUMPHREYS,

P. O. Box 1384. Treasurer.

KELLY & LUDWIG,

720 and 722 Filbert Street,

PHILADELPHIA,

DEALERS IN

Machinery,

Machinists' Tools,

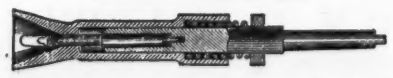
Steam Engines,

Boilers, Pumps

AND

Machinists' Supplies

MANUFACTURERS OF



IMPROVED CENTERING ATTACHMENTS

FOR LATHES.

AGENTS FOR

Fitchburg Machine Works,
Brown & Sharpe Manufacturing Co.,
Geo. F. Blake Manufacturing Co.,
New York Safety Steam Power Co.,
Babcock & Wilcox,
Otis Bros. & Co., Elevators,
Heald, Sisco & Co.,
Bagley & Sewall,
P. Blaisdell & Co.

ESTABLISHED IN 1852.

Torrance, Merriam & Co.,

MANUFACTURERS OF

MALLEABLE AND

Small Grey Iron Castings,

OF SUPERIOR QUALITY,

TROY, N. Y.

The Sabbaton Malleable Iron Coke and Coal Shovels.

Orders Solicited. Illustrated Catalogues sent on Application.

These shovels are made of best Malleable Iron, are very strong and durable, and are great labor-saving coal and ash screens. Every factory, foundry, machine shop, or other place where coal is used in any considerable quantity, should have one or more of these shovels.

Send for price list.

W. M. B. HAMMOND & CO.,

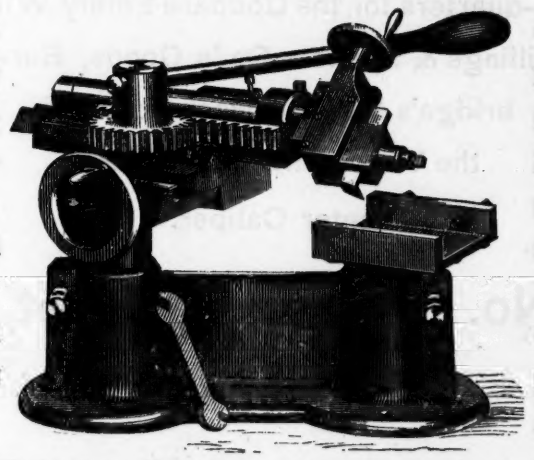
34 Warren Street, N. Y.,

Manufacturers and Manufacturers' Agents.

Old Colony Bench Shear

AND

Lever Iron Cutter.



Hand Planers and Shaping Machines, Horizontal and Upright DRILLS, Knox Improved Fluting Machines, Old Colony RIVETS and BURRS, Carriage and Machine Bolts, Set Screws of all kinds, Machine and Wood Screws, Wagon and Carriage Hardware, all kinds of Malleable and Grey Iron Castings, Washington Mills Emery Paper, Emery Cloth, Sand, Flint and Emery Paper, Lightning Screw Plates, Hub Boxing, Tennoning and Boring Machines, Bolts and Nut Tapping Machines, Taps and Dies, Morse Drills.

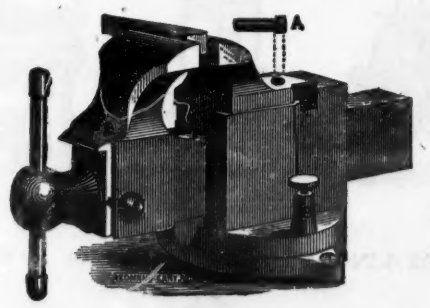
PRENTISS' PATENT

Self-Adjusting Jaw Vises,

ON STATIONARY AND PATENT SWIVEL BOTTOMS.

Complete Without Attachments.

Patents Dated March 17 1868 April 11, 1871. February 6, 1877.



(Fig. 2, with Patent Swivel Base.)

OUR IMPLEMENTS, IN ADDITION TO

Simplicity, Strength and Durability,

Combine all the particular advantages claimed for any rival Vise, and

CANNOT GET OUT OF ORDER.

THEY ARE SPECIALLY ADAPTED TO

Machinists, Manufacturers, Mechanics, Jewelers and Artisans in Wood, Metals, &c., &c.

OWNED AND MANUFACTURED BY

HALL MANUFACTURING COMPANY,

(Works Havana, N. Y.) M. C. LEWIS, Treasurer and Manager.

Office, 23 DEY STREET, NEW YORK.

Circular.

H. PRENTISS & CO.,

Manufacturers of

Goddard's Patent Relieved

MACHINISTS' BLACKSMITHS' AND GAS FITTERS'

Taps; Dies, Reamers and Screw Plates.

The Bee Gimlet and Brace Bits, and Sammis' Patent Self-cutting Lemon Squeezer.

Head-quarters for the Goddard Emery Wheel, Billings & Spencer Co.'s Goods, Burbridge's Patent Tweer Iron, and the Victor Chuck and Micrometer Caliper.

No. 14 Dey Street,

NEW YORK.

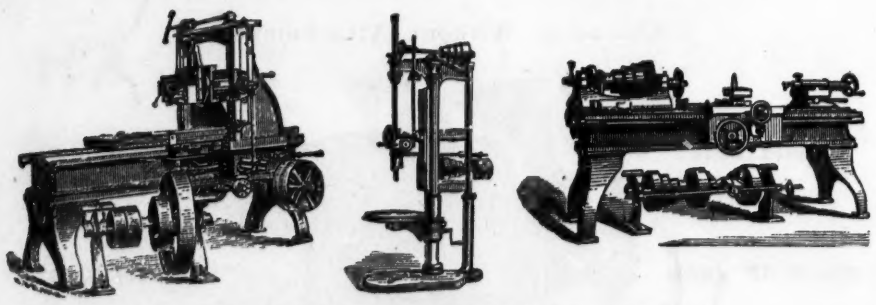
E. A. GODDARD,

GENERAL SALES AGENT.

THE

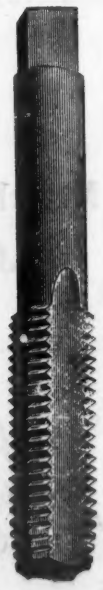
PRATT & WHITNEY CO.,

HARTFORD, CONN.,



MANUFACTURERS OF

Machinists' Tools, Drop Hammers, Cranes, Machinery, Small Tools and Gauges for the Manufacture of Sewing Machines and Guns.



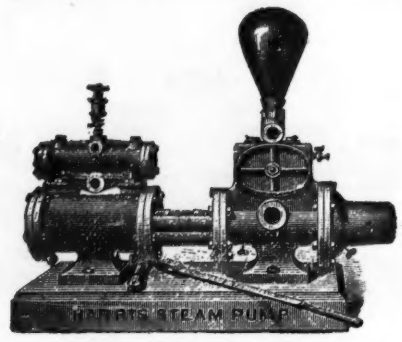
Specialties.

Cutters for cutting the teeth of gear wheels, Hand Drilling Machines, Screw Plates, Hand and Power Bolt Cutting Machines, and Taps for Machinists and Pipe Fitters, of unusual excellence.

Reading Hydraulic Works,

MANUFACTURERS OF THE

HARRIS PUMP,



GENERAL SELLING AGENTS OF

H. R. WORTHINGTON'S

Steam Pumping Engines

SINGLE and DUPLEX, PORTABLE and SEMI-PORTABLE.

We sell the only NOISELESS Pump in the Market suitable for Hotels and Public Buildings.

The following Hotels in New York City have in use the WORTHINGTON DUPLEX PUMPING ENGINES:

Albemarle, Astor, Brandeth,
Buckingham, Clarendon, Coleman,
Continental, Everett, Fifth Avenue,
French's, Gilsey, Glenham,
Grand, Grand Union, Hoffman,
Metropolitan, New York, Prescott,
Rossmore, St. Charles, St. Dennis,
St. James, St. Nicholas, St. Stephen,
Sinclair, Stevens, Union Square,
Westminster, Windsor, Rockingham,
Webb's.

Pumps can be seen at our Warerooms,

87 LIBERTY STREET, N. Y.

BROWN & SHARPE M'F'G CO.,

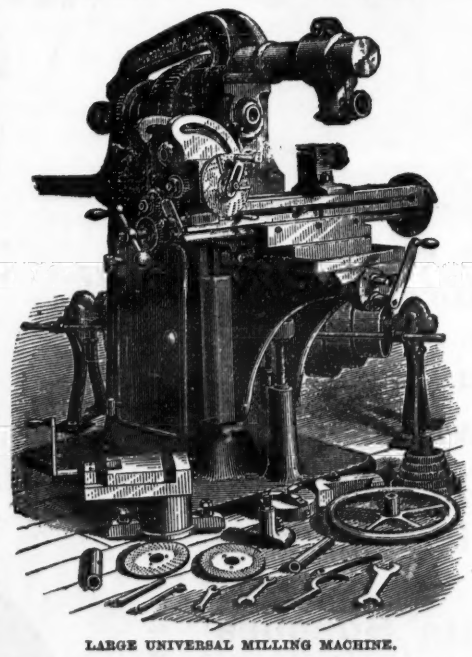
Providence, R. I.,

MANUFACTURERS OF

FINE MACHINERY, SEWING MACHINES,

PATENTED ARTICLES,

Universal and Plain Milling Machines, Grinding, Screw and Tapping Machines, Screw Finishing and Polishing Machines, Reels, Assorters, Scales and Testers for Roving and Yarn for Cotton and Woolen Manufacturers' Use, Patent Cutters for Gear Wheels, and for Taps, Reamers, Twist Drills, Irregularly Formed Sewing Machine and Gun Parts, Milling and Screw Slotting Cutters.



LARGE UNIVERSAL MILLING MACHINE.

PATTERN AND Working Gears Made or Cut.

INDEX PLATES Made or Drilled TO ORDER.

Medals Awarded, Paris Exposition, 1867; Vienna Exposition, 1873; Philadelphia, 1876.

ILLUSTRATED CATALOGUE SENT PER MAIL ON APPLICATION.

DARLING, BROWN & SHARPE,

PROVIDENCE, R. I.,

MANUFACTURERS OF

UNITED STATES STANDARD RULES,

AMES' UNIVERSAL SQUARES, PATENT HARDENED CAST STEEL TRY SQUARES,

The American Standard Wire Gauge,

Bevel Protractors, Hardened T Squares and Bevels, Center Gauges, Steel, German Silver and Boxwood Triangular Scales, Vernier Calipers, Caliper Squares and Rules, Plumb Bobs, Paper Drawing Scales, Willis' Odontographs, Steel Straight Edges and T Square Blades.

Medals Awarded, Paris Exposition, 1867; Vienna Exposition, 1873; Philadelphia, 1876.

ILLUSTRATED CATALOGUE SENT PER MAIL ON APPLICATION.